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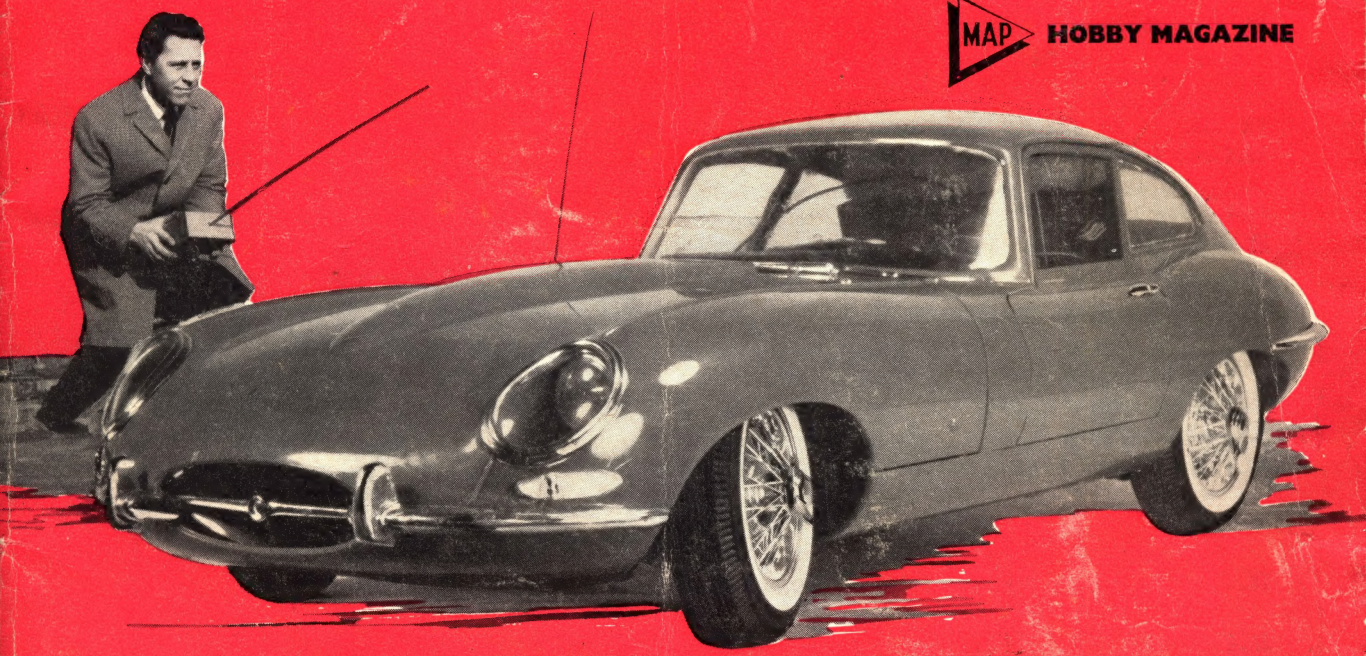

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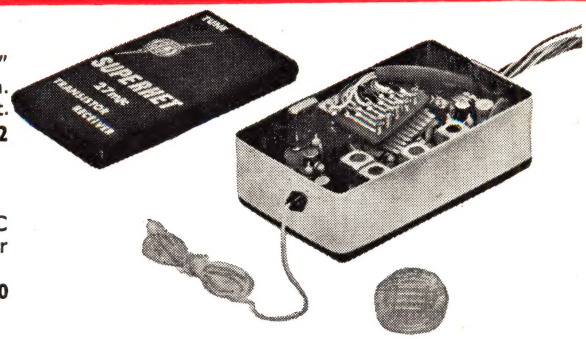

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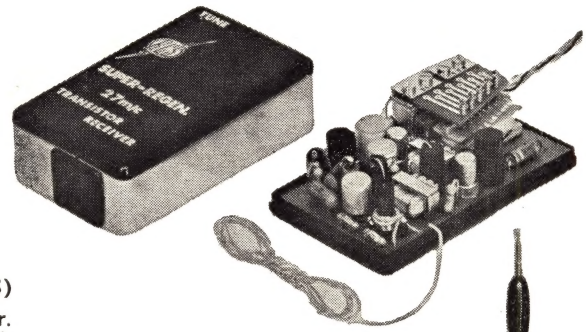

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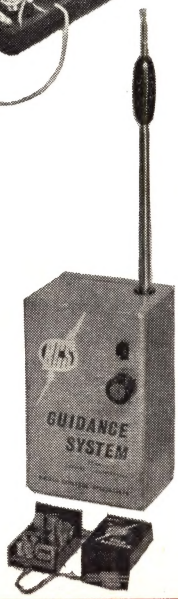

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RADIO CONTROL MODELS & ELECTRONICS

APRIL 1965

VOLUME 6 NUMBER 4

MAP HOBBY MAGAZINE

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NEXT MONTH . . .

Highlights of the issue include :

RADIO CONTROLLED ROBOT
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BOAT INSTALLATION
DUAL PROPORTIONAL TEST
FULL-SIZE MODEL PLAN
COMMERCIAL DEVELOPMENTS
GADGETS & GIMMICKRY

Plus the usual favourites

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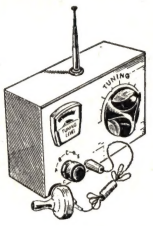

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18v. 100 mA/H 3½ x 1" dia. **30/–** Easily split into single units of **1.22 volts.**

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Complete with fittings

LA1	12/6	LA9	17/6
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American 27.255 mc/s 3rd overtone. Lightweight, wire end for valve or transistor circuits. Only 15/- each. 9.065 mc/s Third Overtone Crystal for Valve Circuits 12/6. Holder 1/-.

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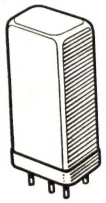

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All 1 pole 2-way contacts.
Size 2 x 1 x ½".

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"WHIT 63"

All parts available for this Rx. S.A.E. with list please for quote.

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D1001 5:1 Interstage ½ x ⅜ x ½
D129 Crystal Mike to Transistor
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PT34 (illus.)	1k ohms per volt		**39/6**
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ITI-2	20k	,,	**89/6**
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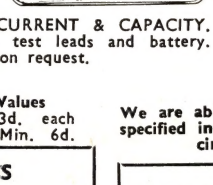

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All transistor receiver as described in December 1964 edition of R.C.M. & E. Total cost of all specified parts including ready drilled and etched printed circuit board (7/6d.): **59/6d.** + postage 1/-.

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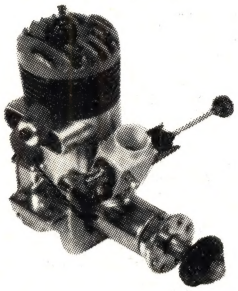

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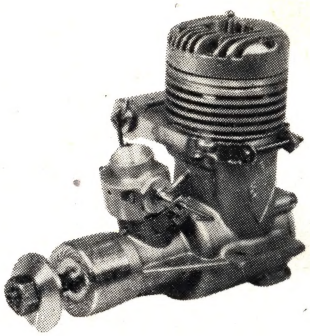

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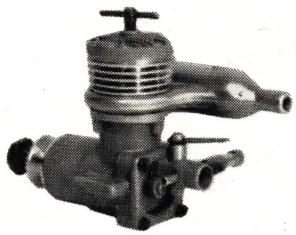

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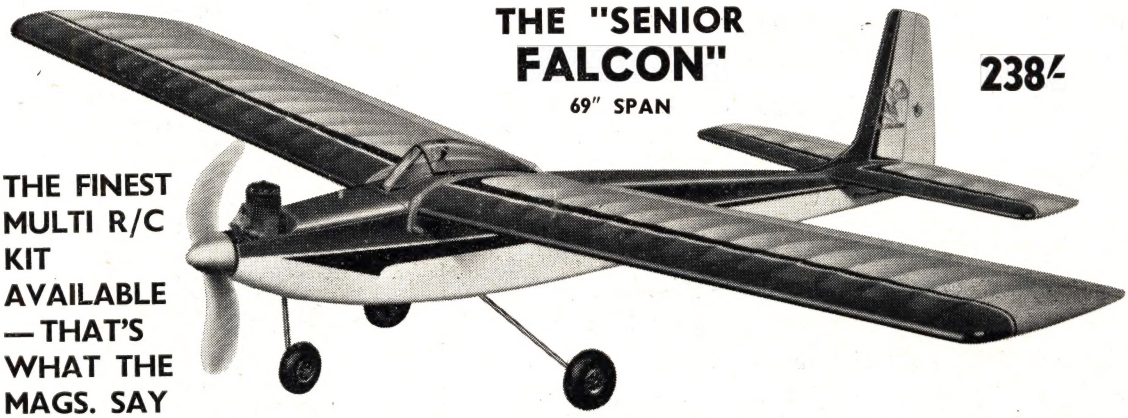

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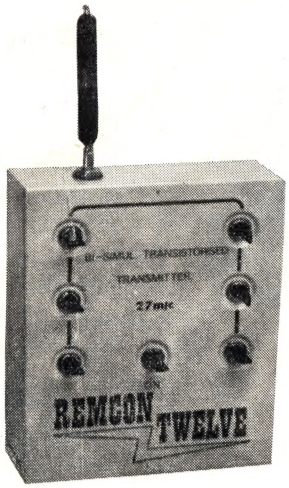

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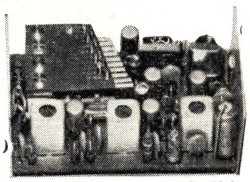

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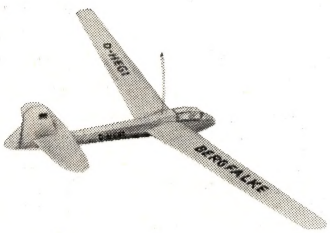

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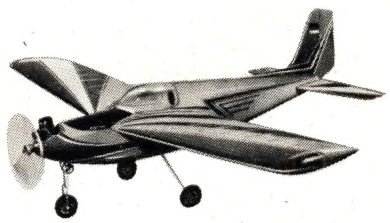

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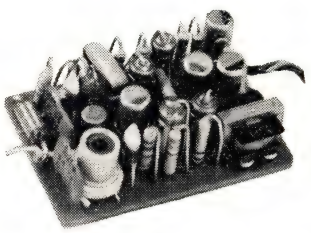

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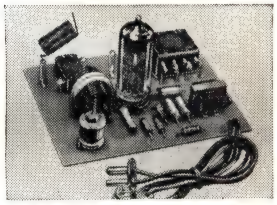

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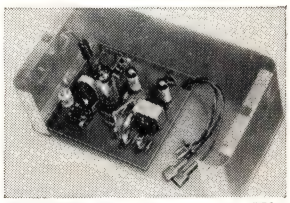

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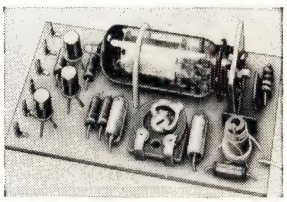
MATCHING CASE & TELESCOPIC AERIAL to ac'modate Tx **£2.15.0**



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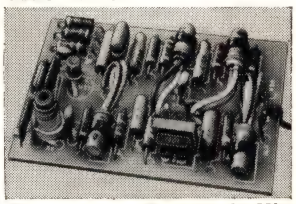
Latest version of this simple reliable receiver — the ideal beginner's project and very inexpensive, too. Panel size 3" x 2". **£3.10.0**



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Here, There and Everywhere

Fly to the Nats ?

WELL, why not? This year's British National Championships will be the usual Whitsun weekend gathering, the date June 6/7th. The venue is R.A.F. Ouston, near Newcastle, a relief landing ground for training flying on a moor overlooking the Tyne valley. To find the position on the map, locate the nearest village of Stamfordham. The R.A.F. Station main entrance is on the B6318.

One easy route from the south is the A1 to Newcastle, then A69 to Heedon to join the B6318. From Scotland, the A68 and A69 are routes to follow.

Those making the rail journey to Newcastle may reach the airfield by bus from the Haymarket.

Understandably, the fastest route from the south is by air. B.K.S. for instance, have a regular airline service between London (Heathrow) and Newcastle (Woolsington) just 7 miles from Ouston. A number of readers have already enquired as to the possibility of arranging air charter from the London area. Although this would represent no considerable saving due to the necessity for holding an aircraft for the whole weekend pending the return journey, there would be a possibility that some fare reduction could be effected if sufficient enquiries were forthcoming.

Those interested should write to the Editor not later than March 12th.

Yachtsman Ahoy

Until recently a radio controlled yacht ('Q' class to those who know) was a massive affair using modified 'A' class models which, whilst there was no difficulty in accommodating the bulkiest of radio gear and the sheer weight of model insured that control was not over 'twitchy', storage and transport were something of a problem. The cost of an A class boat ready built, and quite a few boat enthusiasts do not build their own, is pretty high; fair enough, there is a lot of timber, canvas and spit and polish.

Take heart Skipper . . . if you read January 1965 *Model Maker* you will have seen that the M.Y.A. Committee, South West District, suggested a new rule which has been officially adopted for an 'R' class. The models are much more handy in size and the rules enable one to modify existing Marbleheads by adding a false bow or transom and the Model Maker Plans Service "Wraith" designs "Conrads", etc., are just right. The rules are easy to understand but take up rather more space than we can spare here, there are however, plenty of back issues of January 1965 *M.M.* available. You can use 4 channel R/C gear, or design your own mark/space/rate proportional system, M.S. and P.O.D., or what-have-you to obtain similar, or better results.

We think that the size handicap has probably accounted for the comparatively few R/C yachts around these days. To our knowledge there are only one or two contests and readers of our earlier issues will recall reports on these meetings. A sailing craft can be as exciting to operate as a power model when getting the most out of the available wind for a specified course. No messy engine to start, no expensive accumulators to service; the boat modellers equivalent of slope soaring.

FREE ! . . . EXTRA !

Once in a while, in our big hearted (no, *not* big headed!) way we like to put more than our customary quart into our pint pot. . . . Right, it's time for our 2½ pint'er.

In place of four pages of full-size plan this issue you will find a booklet dealing with the construction of an interference rejection type receiver to combat those Walkie-Talkies. It takes 15 pages of our booklet and would normally have to be split over a couple of issues were it not for this extra offering. You can detach the booklet by freeing the top staple, it then makes a handy size reference manual for use on the workbench.

Contest Fixtures

Pylon race types should look forward to the now well established Rolls Royce W.M.A.C. meeting to be held on April 4th at Derby; same field, B5010 off the A6 Derby to Loughborough. Pre entry for single channel (1/6d.) forms from the Competition Secretary; P. Clarke, 70 Brisbane Road, Mickleover, Derby.

Single channel is defined as "Single button or single acting switch", no engine or area restrictions. . . . Pylon racers are up to 2.5 c.c., no other restrictions. Pre entry: 1/6d. or 2/6d. on the day. . . . Multi (unrestricted) pairs racing R.O.G. (rise off *grass*).

Esher Club are holding another INTERMEDIATE open rally at Odiham on July 18th. (Rudder, Elevator and Engine control.)

S.M.A.E. Events

April 25th. Centralised MULTI.

May 9th. SINGLE and "Magnificent Men in their Flying Machines" contest, this is a scale event which includes radio. . . . See March *Aeromodeller*. If you want a really out-of-the-rut contest, this one is for you.

Boats

The Hull Radio Control Modellers are holding, at the East Park, Hull, on June 20th, 1965, a contest for model boats in:

1 SPEED.
2 SPEED STEERING.

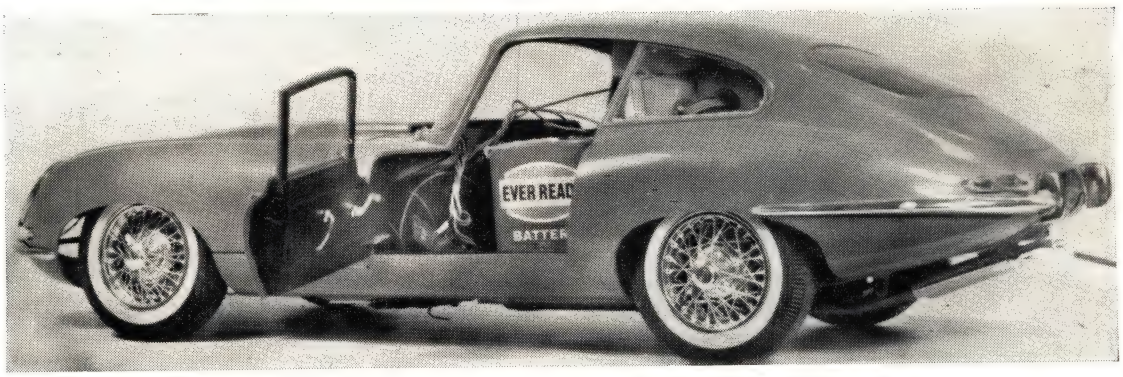
Events to M.P.B.A. rules and,

3 SIMULTANEOUS SPEED.
4 RELAY RACE.
5 ELECTRIC STEERING.

Rules and course on application form. Entrance fee 2/6d./boat/event (for all events). Meals, etc., will be laid on. Application to P. Cowan, Esq., 16 Summergangs Road, Holderness Road, Hull, E. Yorks.

On the Cover

The E-type Jaguar built from a Monogram plastic kit has R.E.P. 4 channel relay equipment, a Duromite to steer and a Permagear to control speed and reverse. Additional home built gadgetry combines to make this an exciting model to drive and all the details including a sketch page should enable others to follow suit. The basic control system can of course be applied to other models and there are plenty of reasonably large toy vehicles in the shops if you are not a precise, detailed scale model enthusiast.



R/C 'E' Type Jaguar

FOUR CHANNELS PLUS GIMMICKS BY M. CHARLES

I WAS feeling a little disheartened . . . the club secretary's single channel model aircraft which I had borrowed, decided to disappear into the gloom one evening. This, on top of the fact that earlier in the day I had lost my own Frog Tutor R/C model after working all night to complete it, really made me think that a change was necessary. . . . Something which did not head for the cold wide beyond, in spite of my efforts to control it.

This is how my introduction to R/C cars began. . . . I still had a Minimac receiver and Fred Rising 4 pawl clockwork escapement, so casting an envious eye at my son's toy box, I 'borrowed' a cable controlled police car.

The escapement was connected by means of a pushrod to operate the steering and there was just enough room for the receiver and additional batteries to power the existing motor in the car. Control response was fast, sequential but easy and the model provided much amusement for the family and the Watford Wayfairers club members.

Now that I was acquainted with the joys of R/C motoring it seemed a logical step to try a large multi controlled model. Among the large plastic scale kits available in this country, is an E-type Jaguar to a scale of $\frac{1}{8}$ in. full size by Monogram. This is a magnificent kit and provides hours of enjoyable construction if one wants to make a glass case job of it.

It was planned to use 4 channel radio equipment and this meant that some of the intricate engine bay detail and the working front suspension would have to go. Anyone who has the parts left over, can always make a separate engine display model.

The first modification to the kit was to add a Marx Monoperm with an 8-speed gearbox. This, set for a 16:1 ratio, was Araldited to a strip of aluminium which was in turn fixed to the chassis underpan with self tap screws. An additional piano wire strap was soldered to the motor case and serves as further reinforcement. A Meccano universal coupling transmits the drive through a Meccano rod prop shaft. The tail end of the shaft passes through a Meccano bracket fixed to the underpan with more self tap screws and the drive to a solid rear axle (more Meccano rod) was made by a 3:1 crown wheel and pinion.

One wheel is free on the axle, the other is driven by a piano wire peg soldered in a slot cut in the end of the axle. A corresponding slot in the wheel hub engages on the pin. Great care is necessary here to avoid softening the plastic when soldering the peg to the axle (we'd Araldite it, Ed.). The rear suspension is liberally covered with Araldite to strengthen it.

Revised steering was the next modification; the whole front axle assembly was re-built with Meccano parts in order to provide a more rugged unit. The holes in the Meccano made a good key for more Araldite bonding and the front stub axles were replaced by bolts.

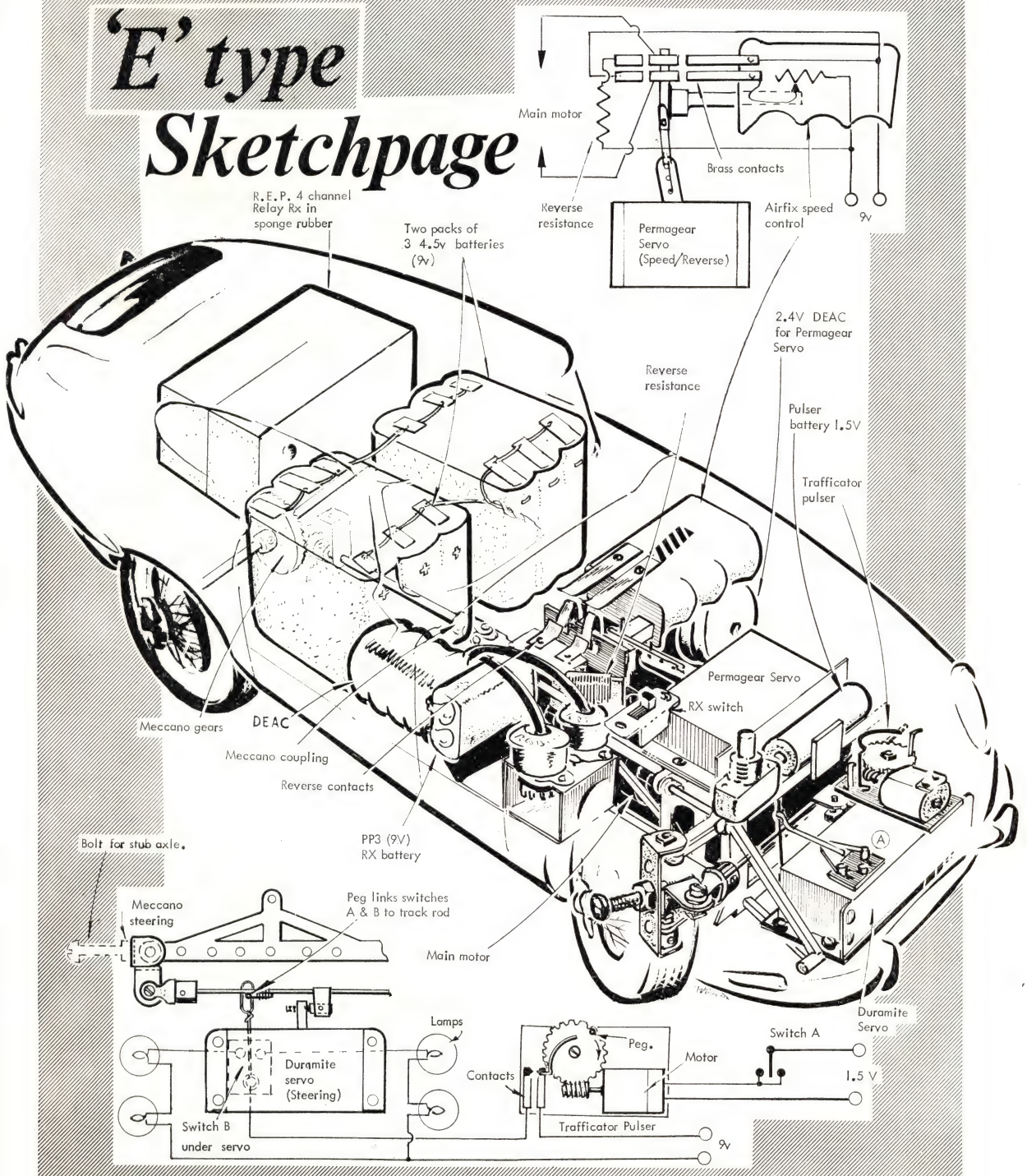
Controls

The front chassis outriggers (B117/B116 in the kit) were strengthened by adding a Paxolin plate which carries a Duramite power centring servo. The servo output lever engages in a metal bracket soldered to a piano wire track-rod and the servo is operated by two channels of an R.E.P. Quadratone relay Rx.

Speed control is resistive and has the additional facility of reverse. A Ripmax Permagear progressive servo is mounted across the scale engine chassis frame over the Monoperm motor and is linked via a wire extension arm to a home built speed control unit.

The heart of the speed control device is an old Airfix controller (normally used on model racing car circuits). The controller was opened up and the spring removed. Sets of contacts made from scraps of brass taken from discarded 4.5v. batteries were fixed to the case of the controller to switch in the 'forward' supply via further moving contacts on a Paxolin plate Araldited to the control plunger. The Permagear moves about three quarters of its travel when depressing the controller plunger. In the remaining quarter of its travel it moves the contacts off the 'forward' pair of contacts to give 'stop', then on to a second pair of contacts fitted to a scrap of polystyrene waste from the kit which, wired via a second wire resistance from another Airfix controller, gives reverse at a fixed speed. It was found that by tapping this resistance about half way along, the correct reverse speed was obtained.

'E' type Sketchpage



The radio operated speed control and reverse system gives plenty of speed with fresh drive batteries (two sets of three 4.5v. flat battery giving 9v.). The adjustable gearbox enables much faster or slower speeds to be obtained, the higher speed range depends on the freshness of the batteries, in any case the model is sufficiently fast on 16:1 ratio to make control in confined spaces hazardous.

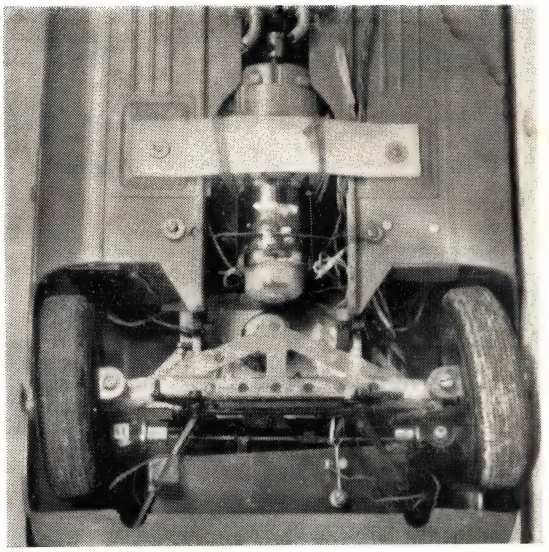
Trafficators

Winking trafficators are fitted to the car using four miniature 4.5v. bulbs in the clear and coloured plastic lenses provided in the kit. Dabs of paint over the rear of the bulbs where they protrude on the inside of the body ensures that excess light does not filter out.

Special switching arrangements were devised so that the trafficators operate automatically whenever the front wheels move off neutral. The winking pulser is a simple switch made from scraps of brass strip to form contacts. These are normally closed but open when a piano wire lever attached to the moving one comes into contact with a peg driven into a Ripmax 40:1 worm wheel and driven by a Kako (3/3d.) motor. The pulser unit was built on a scrap of Paxolin and fixed with Evo-Stik to the Duramite servo case. The motor runs on 1.5v. supplied by a pencell placed over the radiator frame. The pulser motor is switched on by a double sided switch made from more scraps of brass and a discarded three pin socket. This too is fixed with Evo-Stik to the Duramite case and the moving contact, soldered to a piano wire cross piece on the track-rod is adjusted so that when the track-rod moves in steering the car, one or other of the outer contacts 'makes'.

A second, rather similar switch, built on the Paxolin plate that carries the Duramite selects the appropriate pair of trafficator bulbs. The circuit is probably easier to illustrate than describe, it appears at the bottom of the sketchpage and it will be seen that switch A (the first mentioned) has its outer contacts wired together, switch B (dotted) selects the bulbs.

Head and rear lights, like the trafficators, draw their current from the main driving motor battery. A push type on/off switch next to the pencell controls the head and rear lights. A slide switch operates

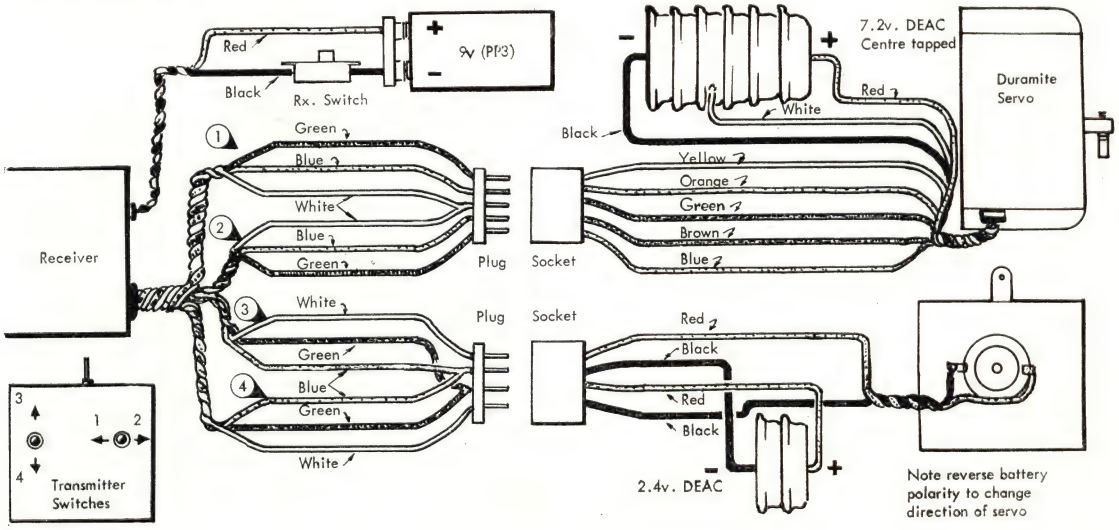


Above : Steering gear and drive motor from below, note the trafficator switch; lower right. Below : Harness diagam shows separate batteries and R.E.P. relay Rx, all as used on this model. Check maker's instruction sheets if you have different equipment.

the receiver, all other batteries being live continuously. Two Radiospares B7G plugs and sockets are fixed to an aluminium bracket bonded to the chassis underpan, these form a convenient termination for the relay leads of the Quadratone Rx.

The main drive batteries occupy the space normally taken by the driving and passenger seats, these are wired to the two pin socket to facilitate quick battery changes to be made. A matching plug is fitted to the leads from the speed control unit. The Duramite draws its power from a 7.2v. centre tapped 500 DEAC which fits under the dashboard and the Permagear has a separate 2.4v. DEAC pack in the engine compartment. The receiver PP3 9v. battery sits behind the plug and socket bracket and the re-

(*Continued on page* 179)



Fast Electrics

PART 2 USING CONTACTORS

By P. CONOLLY AND D. LEMIN

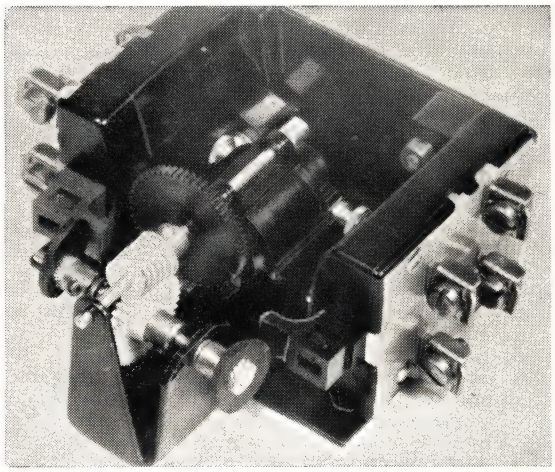
THE two switchers described last month, although completely successful, have their limitations. The relay unit could not be expected to switch more than 15-20 amps without damage to the contacts, and the internal leads would certainly not take a heavier current. A larger relay, possibly a government surplus item for cheapness, could be employed, but the heavier hold-in current has to be taken into consideration. This might represent a fair wastage of power, and the unit could still not be used to give half, as well as full speed. The Milliperm powered switcher requires a fair amount of care in lining up the gears and contacts, and might prove too complex for some people.

For those who would prefer to buy a suitable contactor, here are details of a switch that has been used with very good results in our models. It is produced by the French firm, La Telemechanique Electrique, but is available in this country from Telemechanique Electrique (G.B.) Ltd., Lombard Road, London, S.W.19. The switch is catalogued as an auxiliary contactor and is available in two forms: (a) Type No. ZC1. GP5. This type has one normally open contact, and one normally closed. The two sets of contacts are isolated from each other, and are brought out to screw terminals. (b) Type No. ZC1. GP6. This has two normally open contacts, and is otherwise the same as type GP5.

The weight of each switch is about $1\frac{3}{4}$ oz., although with a little determination this can be reduced to 1 oz. The contacts are rated at 15 amps by the manufacturers, but by paralleling the two contacts of the type GP6, we have repeatedly switched 50 amps at 24 volts, with no apparent ill effects. This is made possible by the neat self wiping, self cleaning action of the contacts, whenever they are operated. The case size is 2 x $1\frac{1}{2}$ x $\frac{2}{3}$ in. with the operating arm and the terminals protruding.

An example of the simplest switcher device that was built using one of these contactors is shown in one of the photographs. This took only 20 minutes to build, and has been very successful. The construction of the unit should be evident from the photograph, a piece of aluminium or brass sheet being bent to the shape shown and the switch and servo being simply bolted on. The switch itself comes with a 5 mm. mounting screw attached to the case making it very easy to mount. The actuator is a Climax Servomite with the self-neutralising wires left open circuit. A number of standard servos or actuators are suitable for operating the contactor. Neither self-neutralising nor limit switches are needed if the keyed signal is stopped as soon as the motor changes speed. One or two of the more powerful clockwork escapements could also be used, and these would give a very nice, quick switching action. A 10 oz. push and a movement of a $\frac{1}{4}$ in. are sufficient to actuate the switch.

The control obtained with the single switch is just stop and go, rather like that used in the fast electric boats on the Continent. These models, some of which

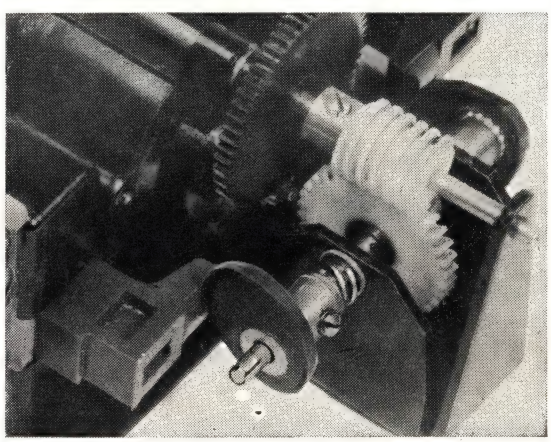


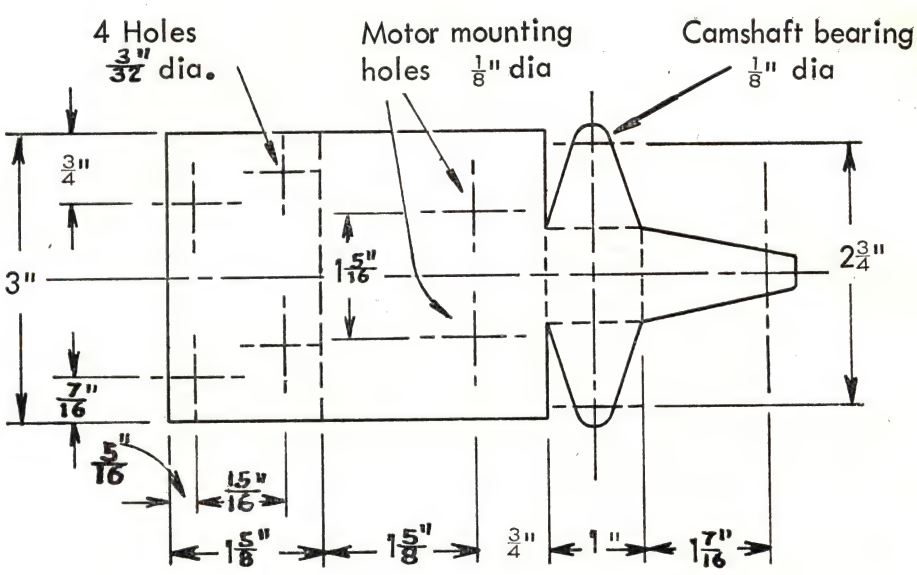
Above : A Mighty Midget powered switcher using contactors. Below : Close-up of the cam system, note simple sheet metal chassis bent to form bearings and the displacement of the two fibre cans. L shaped pieces are the contactor operating plungers. Right : Working details for the unit.

exceed 20 m.p.h., seem to favour a single pair of extra heavy duty contacts driven by the Graupner Servoautomatic servo. To watch them is rather spectacular. The model is lined up by hand a few yards in front of the starting point, and really flies when the button is pushed. However this is digressing a little, and for the reasons explained last month, half speed was an important requirement in our models.

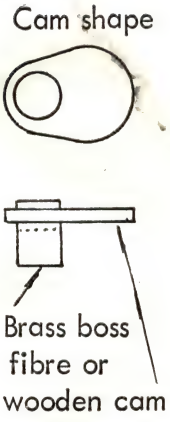
As a matter of interest, we have managed to burn out one of these switches, when the contacts were held very slightly open and a current of 30 amps passed. An arc formed and rapidly melted the contacts and case of the switch, as there was nothing to extinguish it. What happened was that the switcher was being operated by hand, and jammed on the output arm of the Servomite. This of course would not happen in normal service; but be warned.

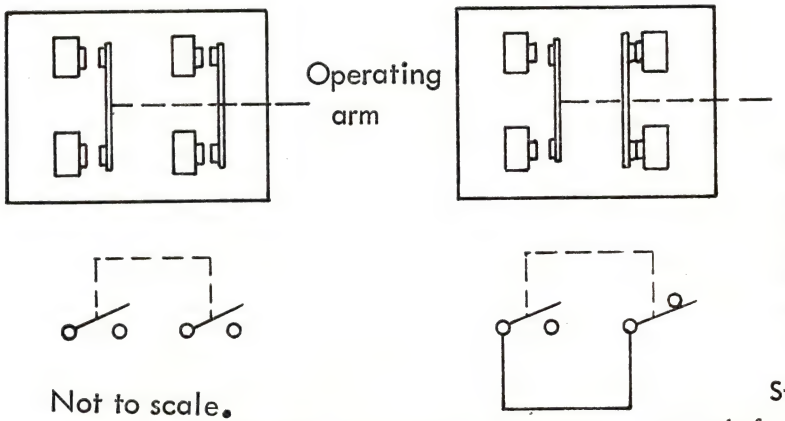
The second switcher, for which constructional details are given, uses two of the GP6 type contactors, actuated by a Mighty Midget motor. The layout and method of operation will be clear from the photos. The unit weighs 7 oz., which although considerably



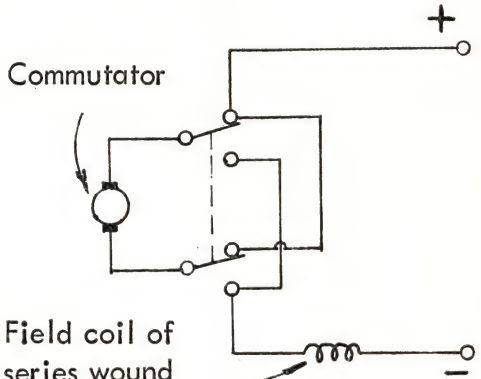


Half full size.





Not to scale.



Reversal of motors using two GP5 switches

Strap for single pole change-over switch

heavier than a standard throttle servo, is not excessive for most electric models, bearing in mind its advantages. The Mighty Midget will run quite happily on 2 volts, drawing 250 milliamps. The highest possible voltage should be used as the time for which an arc can form at the contacts is then minimised. Thus 4½ or 6 volts supplied would be superior.

Construction

The counter-shaft on the Mighty Midget has to be replaced by a 2½ in. length of 3/32 in. rod. Brass and sometimes steel rod of this size can often be obtained at model shops as it is the standard size to fit the R.M.A. gears and pulleys. The large nylon gear on the motor and a R.M.A. worm gear should be fitted on to the new shaft. The chassis for the prototype was made from 16 s.w.g. aluminium sheet. 18 s.w.g. would also be suitable. All holes, except the one for the counter-shaft should be drilled before bending. After bending fit the cam shaft and the 36 tooth gear to the chassis. Check that the gears engage properly with ¼ in. of packing under the motor. If so the position of the hole for the counter-shaft will be evident and this should be marked and drilled. Otherwise adjust the thickness of the packing until the gears fit together and then proceed as before. Having mounted the motor, the contactors themselves can be bolted to the chassis. The 5 mm. bolts were removed and replaced with 4 B.A. bolts for this.

The cams can be made quite simply from two R.M.A. gears or pulleys. Only the brass bosses are

(*Continued on page* 182)

2½° Trim

R. H. WARRING ON THE 'MAGIC FIGURE'

MULTI-CHANNEL control takes most of the critical factors out of aircraft design in a rather similar manner to control line design (and weight) requirements being far less critical than those associated with a free flight model. In other words, given enough control coverage — rudder, elevator, ailerons, engine speed and elevator trim — and the necessary piloting skill, it should be possible to fly virtually any design or layout of model aircraft which is not so badly proportioned or rigged that it becomes catastrophically unstable.

However, there is quite enough chance of 'pilot error' happening without adding 'design error' as another hazard — and 'design error' extends far beyond the layout and proportions of the aircraft. When finished it may well have built-in errors of construction in the form of warps or malignment, etc.; and further errors built in by basic trimming which makes the model harder to fly than it need be, as well as placing limits on realisable performance.

Personally we regard elevator trim as a 'must' for fully satisfactory 'multi' flying, but there is always the temptation to use this as a basic trimming device rather than a flight *attitude* control. In other words, it is much easier to use a little elevator trim to correct a slight natural climb or dive on the initial rigging set-up rather than correct this condition by re-rigging the model itself. If we do we immediately limit the usefulness of elevator trim as a *control* by making it speed-sensitive. Thus the first essential requirement, if we want maximum performance and controlability from the model, is to establish an optimum *rigging* set-up—which means that the model will fly straight and level without any degree of elevator trim (i.e., the elevator is left at neutral or exactly in line with the tailplane) whilst working out the correct rigging by trial and error.

Correction to rigging is then applied in the orthodox free flight manner — except that we are aiming at level flight rather than a natural climb — with the centre of gravity position and the rigging incidences of the wing and tailplane as variables. Alter which is most appropriate or easy, but only one. If the balance point checks out near enough to the design position take out a little wing incidence with packing under the leading or trailing edge as appropriate (low or high wing, respectively) *or* pack up the tailplane leading edge to increase its rigging incidence. A packing thickness of $\frac{1}{16}$ in. at a time is all that is needed to show up a change in flight attitude, and when the right amount of packing has been established, cement it in permanently.

In some cases this may result in the tailplane rigging incidence being slightly greater (i.e., more positive) than that of the wing. Most authorities agree that this is acceptable and may even be necessary with a very light, fast model. Personally we are never happy with such a rigging and would prefer in such a case to move the balance point forward somewhat and re-trim to arrive at a 0-0 wing-tailplane set-up. However, that seems largely a matter of opinion, and there is always the elevator available to counter any unexpected tuck-in which could occur at a very low angle of attack. In any case, negative decalage as rigged will become effectively zero decalage at a normal flight attitude with the wing at a positive angle of attack, and positive decalage at some higher angle of attack due to downwash effect. Negative decalage (rigged) could, in fact, make the best trim for normal flight.

There is, of course, also downthrust to play with. If the design plan shows a particular downthrust setting this will probably be built into the assembly anyway and should be accepted as correct. Any downthrust angle is purely arbitrary anyway, related to some geometric datum line which does not necessarily have any definite relationship with the normal flight path of the aircraft. We have to have some sort of datum anyway to establish rigging angles, but what really counts is how these angles ultimately work out after trimming.

Downthrust adjustment alone, for example, can have little appreciable effect if the basic rigging is wrong. If there is too much decalage (i.e., wing at an appreciable positive rigging angle relative to the tailplane) it may need a quite fantastic amount of downthrust to 'cure' a climb — as much as perhaps 15 to 20 deg. The same effect might be realised by a change in rigging angle of only one or two deg. on the wing (reducing the rigging incidence) or tailplane (increasing the rigging incidence).

The datum line serves its purpose since, having related the wing rigging incidence to it (normally of the order of 0 deg. on a typical multi model) and the thrustline we get what is really the significant downthrust angle — the relationship of the thrust line relative to the wing. Here a little 'positive decalage' (i.e., thrust line angled downwards a matter of a couple of degrees or so) is always useful. Never overdo downthrust but, equally, never fall for the fallacy that 'downthrust is inevitably wasted power'. It is not, properly applied, as any 'correction' it produces would otherwise have to be produced by something else, such as less efficient rigging angles.

Having sorted out the basic rigging of the aircraft this should then remain permanent and unchanged, unless the machine is flying a natural turn. If it is, straightening out the turn — another requirement of 'basic' trimming will result in a slight increase in over-elevation which will need trimming out by further slight adjustment of rigging angles. If you prefer you can try straightening out the turn first, then

adjust the rigging for level flight, but that again may result in a certain amount of inter-relationship depending on what is causing the turn. If it is a wing warp you can be in trouble for it will never 'correct' properly. If merely misalignment of the model, or just the fin, the answer is simply a matter of geometry — get everything set up true. Then you have only to bother about propeller torque producing a natural turn.

The 'turn' control in basic trimming is sidethrust — not trim tabs on the wing or rudder which are, again, speed-sensitive devices and so do not produce a consistent trim. Sidethrust is, of course, also speed-sensitive in that with reduced thrust torque is actually *increased* but sidethrust force is *decreased*. However, there is not very much we can do about that, nor does it appear to have any great practical significance in a majority of cases. If you want to be meticulous, adjust the sidethrust to provide dead straight flight at a specific throttle setting, preferably maximum revs where the thrust effect will also be at a maximum and torque a minimum. This at least will ensure keeping sidethrust to the minimum required, and if the model makes a marked turn to the left when throttled back then look for the cause of the trouble elsewhere (probably a warped wing).

Having got basic rigging sorted out to final satisfaction, now is the time to adjust elevator trim movement, as necessary. The degree of elevator movement required for adequate trim control is surprisingly small, although this will vary with the type and weight of model, and also the power/weight ratio. A fast flying model will need less trim movement than a slower flying one, assuming similar elevator proportions.

Basically, for normal aerobatic flying, full up elevator trim should give a marked departure from normal 'straight and level', but restricted to a slight or moderate climb only. The amount of full down trim required should correspond either to a slight climb in the inverted position, or level flight inverted, as preferred. The latter has the advantage that inverted 'straight and level' trim can be selected by holding on full 'down' trim rather than having to adjust trim back from the full 'down' position. Some flyers prefer it that way; others prefer slightly more 'down' trim so that inverted turns can be made without losing height or having to compensate with normal elevator movement.

The other control movements, elevator and ailerons, can then be adjusted to give the required looping and rolling performance, respectively. This is mainly a matter of trial and error, and again matching requirements to personal preference. Some — in fact most — experts prefer to fly loops on full elevator movement rather than having to control the looping radius by blipping — which usually means that the elevator movement is so restricted that the model will not spin properly, calling for additional 'kick-up' movement to enter this manoeuvre. Aileron movement basically controls the rate of roll, although differential movement may also need adjusting if adverse yawing effects are experienced. At this stage of final trimming out, too, any faults in alignment or warps will show up quite markedly by producing assymmetric manoeuvres.

All this — right at the end of the article — brings us to the title of '2½ degrees trim'. The basic trim figures should correspond to these limits, but not the main flying controls of course. In other words, 2½ degrees should be the ultimate figure arrived at for

(i) sidethrust
(ii) downthrust
(iii) elevator trim movement up and down.

If any of these three exceed 2½ degrees, then something is usually wrong somewhere in the basic trim set-up. If necessary, start again from scratch to find it.

Our Companion Magazines

March **AEROMODELLER**

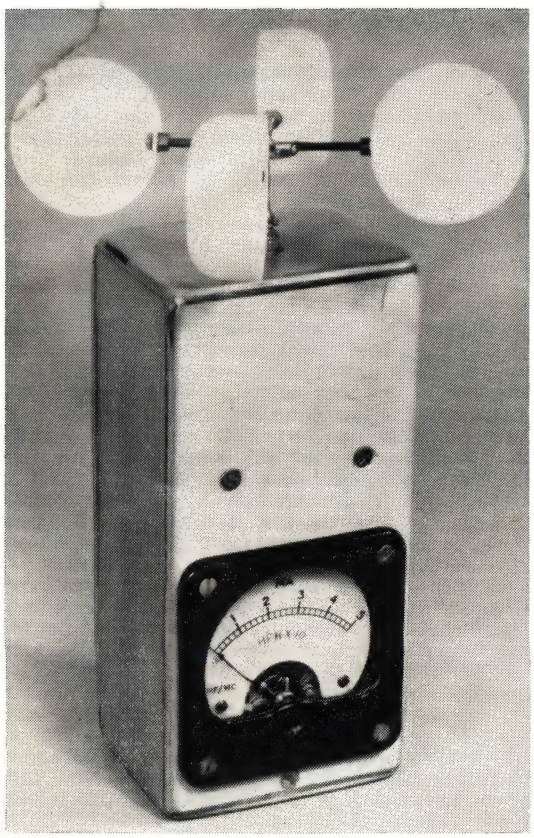
A LARGE semi-scale stunter for .35 size engines joins A.P.S. and it is a design with a distinct difference. Having strong resemblance to the North American Aviation fighter it is called **Mustunt** and comes from ace Swedish flyer Erik Bjornwall. Winter is still very much evident in the Northern Hemisphere and thoughts turn to indoor activity. Larry Renger's **Breeze** has already gained a great reputation in the States and so we're including full size plans for others to enjoy this fine low ceiling design which will get you over the 10 minutes stage. No bracing, no curves, just clever simple lines. Details of a great new scale model contest in connection with the new **Magnificent Men in their Flying Machines** film will be given along with a pictorial feature on the fascinating re-builds and "specials" flown in the making of the film.

March **MODEL MAKER**

FULL-SIZE PLANS for a "schools project" sailing catamaran, the biggest A class yacht yet published, all the gen on propellers, the "Santa Maria", casting procedure for model soldiers or similar work, a 24 pdr. gun drawing, a smart new power boat are among the contents.

April **MODEL CARS**

PROTOTYPE PLANS of sensational 1964 Japanese F/1 car — Honda plus McLaren Cooper Zerex and Oldsmobile plans in a three-car selection feature. Chassis for 4wd steering. Making a Magnetiser. Building feature on British and U.S. shells covering principal makes and methods. Laurie's Workshop (held over from March issue). E.C.R.A. Annual General Meeting Reported. Racing Car Show. Trend of the Trade. Readers Write. Club News. Chopping Miniatures.



CHECK THE WIND SPEED WITH THIS SIMPLE

ANEMOMETER

By W. HOCKEY

AN Anemometer may sound like a complicated piece of equipment, this particular example comprises no more than a miniature motor which serves as a dynamo and an ordinary Milliameter fed via a resistance to measure the amount of power generated. If you need to find the approximate wind speed, try W. Hockey's advice. . . .

Requirements

One Mighty Midget motor or similar.
One 0 to 5 Milliamp Meter.
One 250 ohm wirewound preset.
Four National Dried Milk ½ oz. measures, half table tennis balls, or other suitable cups for rotor.
One 16 gauge threaded bush, 8 B.A. nuts and bolts, scrap tinplate, ⅜ in. screws.
One sq. ft. of ⅛ in. ply, 1 ft. ¼ in. sq. bearer.
One 0.1 mfd paper condenser.

Construction

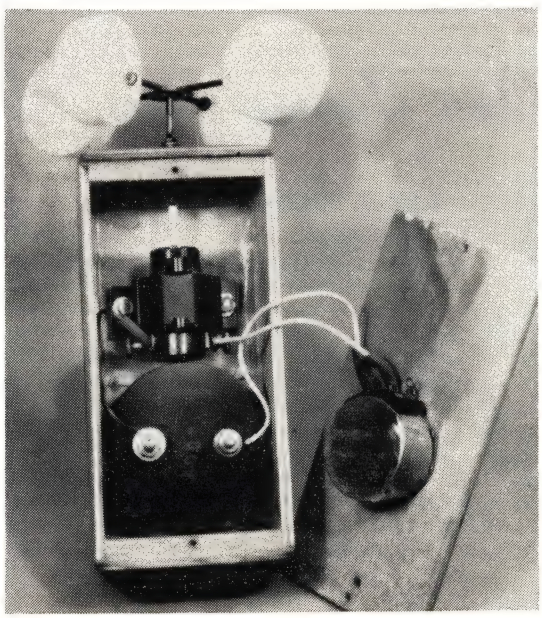
The construction is quite simple and before any of the components are fitted into the case it can be completely finished. Fret out the six pieces and drill all the necessary holes including the large one for the milliameter. Glue the pieces together and leave to set. The box can then be rubbed down. I gave mine a couple of coats of wood preservative and then a coat of clear dope to shine it up.

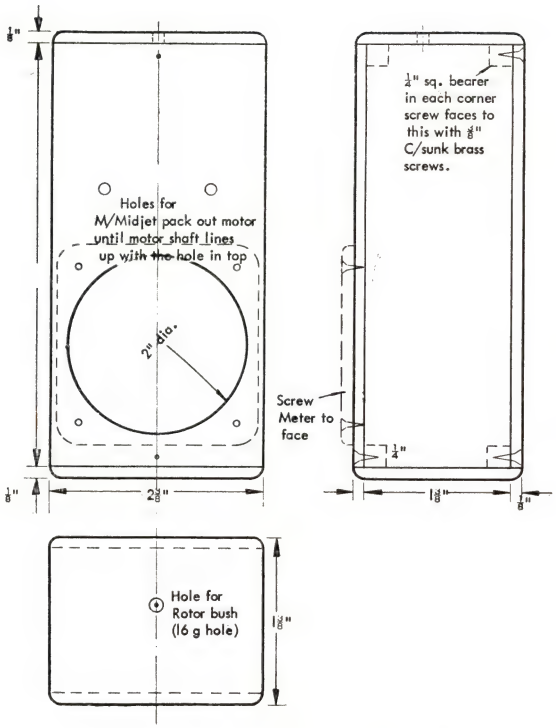
When the case is finished the milliameter, motor and pot can be screwed in place. The hole in the top of the case should be slightly larger than 4 B.A. clearance ($\frac{7}{32}$ in.) to allow for final adjustment when the rotor shaft is installed.

The rotor should be made next. Cut a metal disc from tinplate $\frac{5}{8}$ in. in diameter. Drill a $\frac{1}{16}$ in. hole in the centre. A 2 in. piece of 16 gauge piano wire should be soldered into the disc; ⅛ in. protruding out of the top half. Four 8 B.A. bolts with the heads cut off are then soldered on to the disc at right angles to each other.

The National Dried Milk cups with the handles cut off (my cups are in white plastic and a modelling knife was used) and holes drilled in each ⅛ in. from the rim are then mounted on the four shafts. The rotor is then balanced by moving the cups along the shafts until the rotor when spun will not stop in any one position. When this has been accomplished the cups should be locked on with a locknut.

The bush for the rotor bearing is then fitted loosely in the top of the case and the rotor shaft connected up to the Midget with a piece of sleeving or Neoprene tubing. **It is most important that the motor shaft and the rotor shaft are connected up as freely**




Holes for M/Midjet pack out motor until motor shaft lines up with the hole in top
2" dia.
¼" sq. bearer in each corner screw faces to this with ⅜" C/sunk brass screws.
Screw Meter to face
Hole for Rotor bush (16 g hole)

CASE DETAILS - ⅛" PLY WOOD USE IN CONSTRUCTION

Heading photograph shows the neat appearance of the Anemometer. Treat it with care though, a bent shaft will give a false reading. Left : Back removed to show motor, coupling and calibration pot. Do not touch this pot once the setting up procedure is complete. Sketches show construction and wiring.

Fig. 2

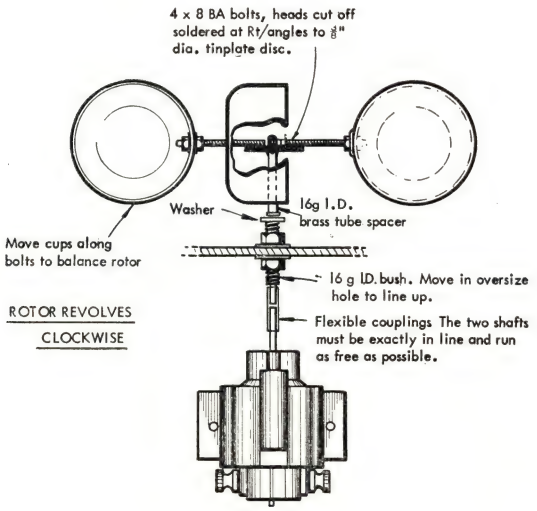

4 x 8 BA bolts, heads cut off soldered at Rt/angles to ⅜" dia. tinplate disc.
Washer
16g I.D. brass tube spacer
Move cups along bolts to balance rotor
16 g I.D. bush. Move in oversize hole to line up.
ROTOR REVOLVES CLOCKWISE
Flexible couplings The two shafts must be exactly in line and run as free as possible.

Fig. 1

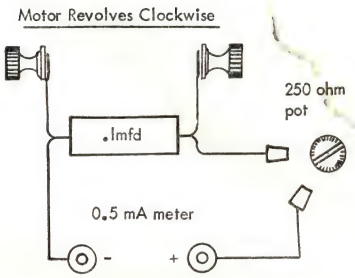


Fig. 3

as possible and the motor runs freely ; otherwise the indicator will only work in gale force winds. When you have done this, lock up the bush nuts so the bush will not move when the rotor is spinning.

The Midget and milliameter can then be wired up; if the meter registers a negative generation of current just reverse the two leads from the Midget.

Setting Up

Calibration is quite simple. Wait for a calm day or evening and then ask a friend (with car) to drive you along at a steady 30 m.p.h. You then twiddle the pot until the meter reads 3 on the scale which indicates an air speed of 30 m.p.h. Check it out on a different vehicle and don't do all the runs in the same direction just in case there is a head or tail wind. Be sure to hold the instrument as far out of the window as possible so that turbulence caused by the car does not give a false reading.

The meter was designed to aid slope soaring where notes can be made of particular trim settings in various wind speeds and records kept. This enables one to go out, read the wind speed and trim the model to fly correctly in that particular speed. It is also very useful for single channel power flying, especially those tiny models for which that much too high a wind speed can be disastrous. One can mount the device on a pole about 7 ft. high well clear from tents, cars or other obstructions likely to produce turbulence.

". . . Sell R/C to the natives . . . Umm . . . there might be an interesting response."

GADGETS & GIMMICKRY

R.F. Probe (Sketch **A**)

THE first of two gadgets submitted by D. A. Olley uses a discarded Bic or similar ball point pen. He finds that when building a direct reading R.F. probe for connection to a multimeter in accordance with the circuit illustrated, all the components fit inside the empty case.

The sketch shows the case 'ghosted' so that the wiring can be followed. The co-axial cable which connects it to the meter is pushed into the top end of the pen and bound with p.v.c. insulating tape. It is important to use co-axial at least 12 in. long as it forms an integrating capacitor.

The meter will read R.F. volts R.M.S. on the D.C. range if the resistance R = .414 x voltage range x meter sensitivity. i.e., with a 20,000 ohms/volt meter on the 10 volt range, R = 82k ohm. Deleting R gives a peak reading volt meter.

Hook-on Probe (Sketch **B**)

The second Olley idea is intended to be applied to almost any test probe, simply cut a narrow slot, as shown, near the probe tip (in the metal part of course). This enables the probe to be hooked on to a convenient component lead when making a test and leaves the hands free for making adjustments. This idea enables one to reach and hook on to connections not readily accessible to a crocodile clip type of connection.

Linkage Adjuster (Sketch **C**)

R. Charles uses pieces of broken nylon airscrew to make adjustable clevices for pushrod ends. Cut a 1 in. length from near the blade root and slice it into ¼ in. square sections. Slot one end to accommodate the control horn and drill it for a tapping fit on an 8 B.A. bolt which cuts its own thread in the nylon. The holes in the bellcrank are enlarged slightly to *clear* the bolt.

Drill the other end of the nylon so that a bicycle spoke will tap its own thread for adjustment.

If the length of rod between the balsa pushrod and a clevice is only about 6 in. then the spoke can take the place of the piano wire normally used. If a particularly rigid linkage is designed, which requires several bends, then it might be advisable to bind and solder the short threaded end of the spoke to a conventional 16 s.w.g. piano wire pushrod end.

Fuel Filling (Sketch **D**)

Why decant fuel into a squeeze bottle, then squeeze it into the fuel tank? So many modellers do this, risking grit in the fuel and even soggy knees. . . .

This Birmingham contributor (who omitted to sign his name) modifies his large fuel cans (½ or 1 gallon size) as shown in the sketch. The idea saves much time and only requires the use of a car foot pump or even a bicycle pump with suitable adapter. If 12 s.w.g. brass tubing is used in the 'bowser' then 10 oz. of fuel can be pumped into a model tank with seven strokes of a 5 in. foot pump, this takes about 20 sec.

In the sketch 'A' is a tubeless type car tyre valve obtainable from any garage which is carefully fed in through the can cap and pushed out again via a suitable hole in the top, the rubber body of the valve is then self sealing Tube 'B' has a V shaped cut in its lower end and reaches the bottom of the can. The Neoprene filling tube plugs on to its upper end. Tube 'C' is a vent, it can also be used as a pourer for filling other bottles. Proceed as follows: Plug the filler tube on to the tank, making sure the can lid is screwed on tightly and connect the pump to the valve. Place one finger over tube C and pump gently until tank overflows. Remove finger from tube C immediately to release the excess air pressure. The end of the filler tube can then be parked on tube C to prevent fuel leakage.

Linear Output for a Unimite (Sketch **E**)

Several methods of converting rotary to push/pull action have been mentioned in earlier issues of *R.C.M. & E.* and a similar purpose-made linkage was suggested in the "Painless S/C Flying" last month. M. Emery submitted the next two ideas about the same time, as the one sketch here uses a standard C & L Developments' trim bar, available separately we felt it was worth including among these gadgets. The application shown is the same as the "P. S/C" and it so happens that when used on the Unimite pack the standard C & L trim bar fitting, when pivotted on a bolt locknutted to the rudder Unimite case, lines up nicely with the crank on the throttle Unimite. The eyelet in the latter can be replaced by a bolt, or a small bolt passed through the centre of the eyelet. This enables the Unipack to be used with the linkage shown in his next gadget.

Throttle Linkage (Sketch **F**)

Models like the Veron Robot, which have plenty of solid block balsa around the nose, require the use of a very long drill if a way for the throttle linkage is to be made. Some modellers dodge around the problem by fitting an external linkage but this is not particularly neat and is rather vulnerable.

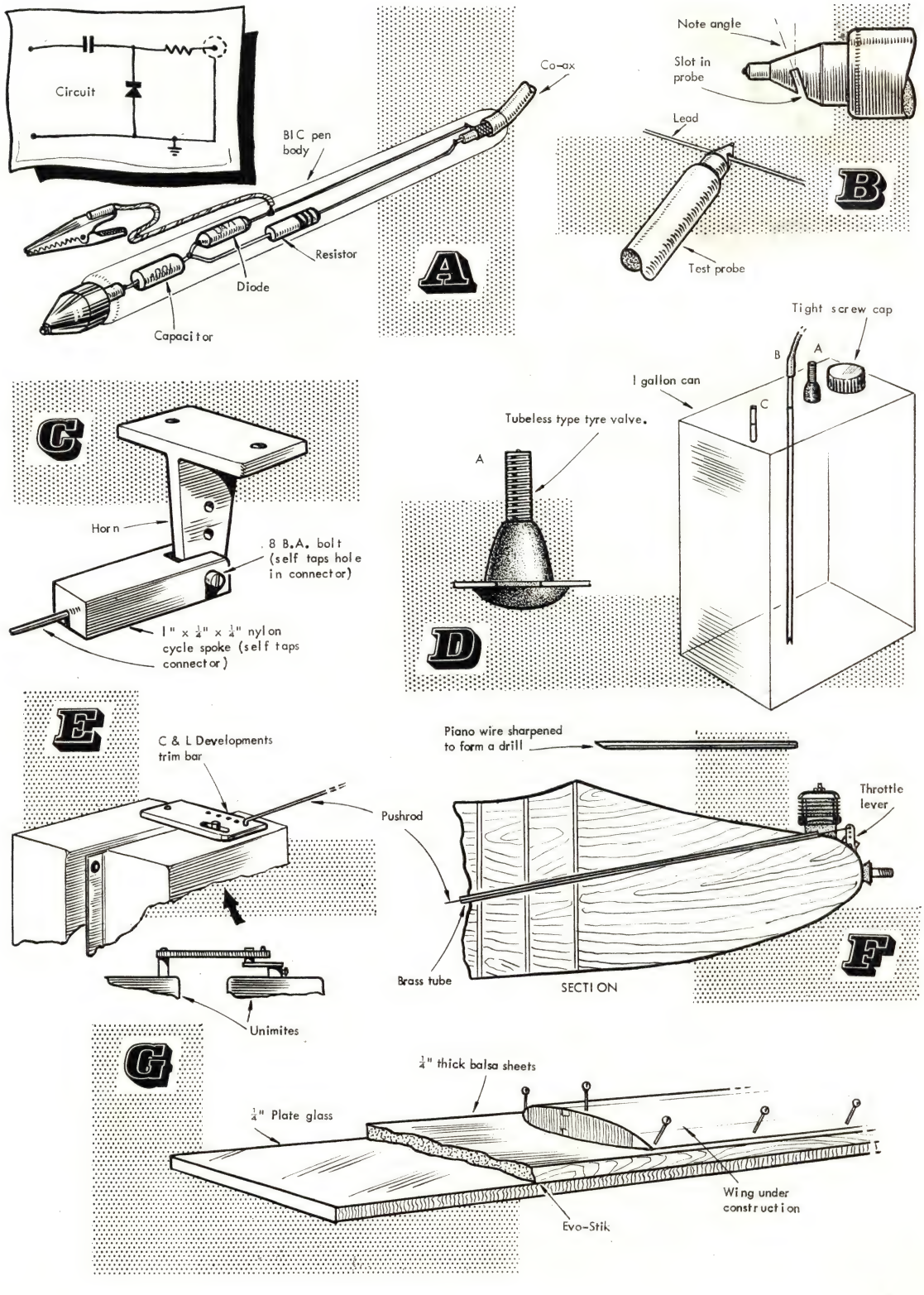
The answer is to file the end of the piece of 10 s.w.g. piano wire to a screwdriver type point and use it in a hand drill to bore through the block for a piece of brass tubing. A dab of Araldite at the motor end holds it firmly in place and prevents fuel seepage into the block. Thin piano wire, 18 gauge or smaller, forms the pushrod and taking advantage of the near linear throw of the previous actuator linkage gadget, does not need much unsupported length at the rear end.

Flat Building 'Board' (Sketch **G**)

An absolutely flat building board is essential for building warp free structures. Well its nice to start with a warp free structure . . . no matter what you do to it at the covering stage!

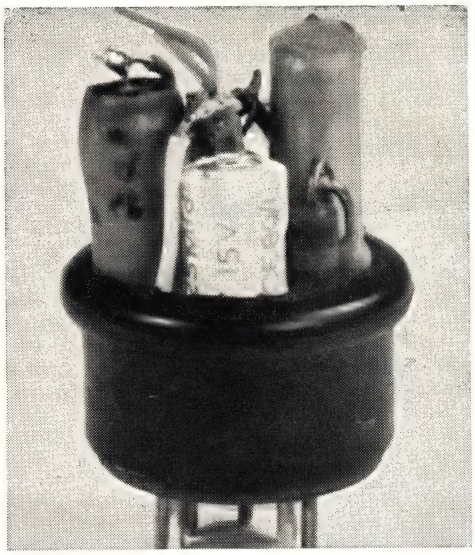
A. James uses a piece of plate glass which at one time served as a shelf 12 in. wide by 36 in. long. Some builders have used this idea before; laying the glass over the plan, but such a system needs great care in lining the construction up accurately when there is ¼ in. of glass between the lines on the plan and the balsa. Furthermore, weights have to be used to hold the ribs, spars, etc., in place. Similarly with the glass *under* the plan the board becomes cluttered with pairs of pliers, half house bricks and empty tea cups in an attempt to hold the structure together while the glue sets.

The "James" board has three 4 in. wide sheets of hard ¼ in. balsa bonded to the glass with Evo-Stik. Modelling pins can now be pushed into the balsa and a warp resistant board results, thanks to the plate glass base.


Circuit
BIC pen body
Co-ax
Resistor
Diode
Capacitor
A
Note angle
Slot in probe
Lead
Test probe
B
Tight screw cap
A
B
C
1 gallon can
Tubeless type tyre valve.
A
D
G
Horn
8 B.A. bolt (self taps hole in connector)
1" x ¼" x ¼" nylon cycle spoke (self taps connector)
E
C & L Developments trim bar
Pushrod
Unimites
Piano wire sharpened to form a drill
Throttle lever
Brass tube
SECTION
F
¼" thick balsa sheets
¼" Plate glass
Wing under construction
Evo-Stik
G

Bill's Basket

A PLUG-IN SWITCHER FOR SPRING CENTERED ACTUATORS By BILL WELLS



SEVERAL excellent servo amplifiers have already been published in *R.C.M. & E.* but, in the writer's humble opinion, most of them present installation and maintenance problems. The B7G has been designed to simplify installation, and to take up as little space as possible. It is suitable for most spring centred, trim, or clutch type servos working off a 4.8 to 6v. centre tapped battery and having a stall current about 400 mA maximum; the writer uses Bellamatic IIs.

No originality is claimed for the theoretical circuit shown in Fig. 1. It was first published by Vincenyo Martini in *R.C.M. & E.* of July '63, and has proved to be a very reliable performer when built into a B7G plug.

Before starting, constructors are strongly advised to purchase miniature components, and try a test hook-up before attempting to build the amplifier into the B7G plug. The reason for this is that, due to variations in components it may be necessary to increase the value of C1, or C2, or both, from 10 mf to 25 mf. The need for this will be displayed by the reluctance of the motor to complete its full travel. If increasing the value of the capacitors does not give positive servo motor response, the transistor will have to be changed for another.

It is important to note that this amplifier will only work correctly from a vibrating reed, it is no good conducting the test hook-up by closing the reeds manually.

Once the test hook-up is working correctly, construction of the B7G can start in earnest, referring to Fig. 2.

Assembly

1 Remove the cap from the B7G plug, and tin the exposed pin ends with solder, proceed as follows:
2 Fit R1 (1.7k) between pins 1 and 2.
3 R2 (10k) between pins 2 and 3.
4 R3 (10k) between pins 4 and 5.
5 C1 (10mf) between pins 1 and 8. Positive end to fin 1.
6 C2 (10mf) between pins 5 and 7. Positive end to pin 5.
7 C3 (.01mf) between pins 4 and 6.
8 Wrap a turn of Sellotape round both transistors and sleeve lead.
9 Fit VT1, B pin 2, E pin 3, C pin 4.
10 Fit VT2, E pin 4, B pin 5, C pin 7.
11 Fit output leads to pins 4 and 6.
12 Ensure that all leads are insulated from one another by an airspace. (If it is not intended to "pot" the unit, all exposed leads should be sleeved before fitting).
13 Enlarge the hole in the plug cap until the cap can just be forced over the components.

"Potting" of the unit is not really necessary, the B7G cap holds the components rigidly.

A word here about the transistors, although OC81 is specified, virtually any medium switcher that is rated at above 300 mA will work. The writer has used 200 mA transistors without failure, they just do not have time to get really hot in normal model aircraft use. If you have had plenty of experience at soldering transistors with very short leads, you can mount them correct way up, otherwise upside down mounting please. The latter method actually reduces the overall height anyway!

The socket connections are shown in Fig. 3. You

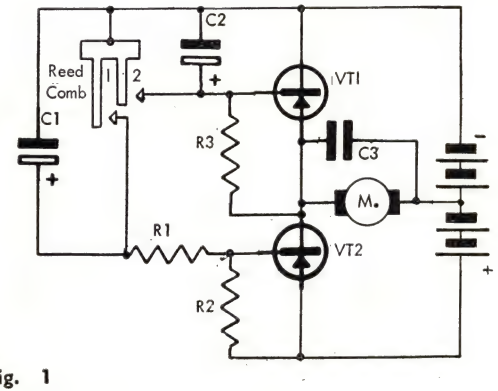


Fig. 1

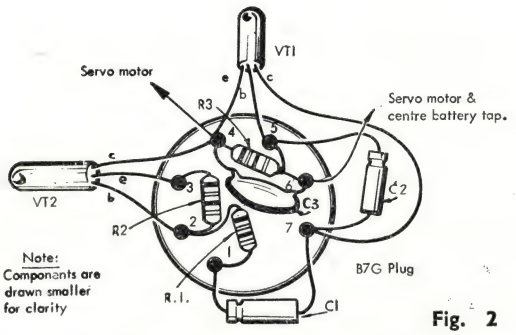


Fig. 2

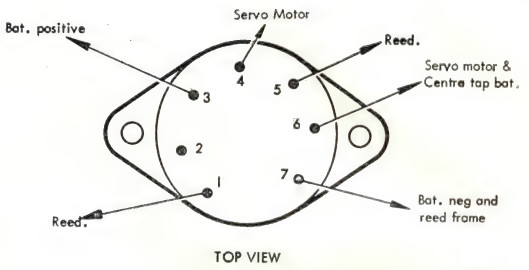


Fig. 3

will require a B7G amplifier and socket for each two channels. Wiring the sockets is simple because connections 3, 6, 7, are common to all sockets.

If the constructor prefers, the output leads can be taken from pins 4:6 on the socket instead of coming from the plug; this does simplify transferring the amplifiers to another model if required.

Components

R1 : 1.7K

R2 : 10K

R3 : 10K

C1 : 10 mf* elect.

C2 : 10 mf* „

C3 : .01 mf

VT1 : OC81*

VT2 : OC81*

**See text.*

Heading picture shows all the bits in in the 'basket', whilst the view on the right shows the connections more clearly. Both photographs are almost twice full-size for the sake of clarity. Keep the leads between the socket and the servo short.

FAST ELECTRICS

(*Continued from page* 161)

required, and a fibre or $\frac{1}{8}$ in. plywood cam is tapped on to the knurled part of the boss. A suggested shape for the cam is given, although this is not critical. Both cams are mounted on a length of $\frac{3}{32}$ in. brass rod.

The total cost of the unit is about £2.0 0d., the contactors being 12/- each. This may be considered expensive for a home made actuator, but is still cheaper than the average throttle servo. The total building time for the original switcher was rather less than two hours.

Methods of Use

In the Swordsman model, the switcher is used to give stop, half, and full speed in this order. By re-adjusting the cams, any other order of operation can be obtained. A short stop position must be left between half and full speed, or the accumulators are momentarily short circuited. In order to switch accumulators into parallel, two make contacts and a break are needed, hence either two GP6 or one GP5 and one GP6 switches can be used. The spare contact can be used to switch on lights or any other desired auxiliary function.

The standard Taycol motors require only a single pole change-over switch to reverse them. Thus one GP5 and one GP6 can be used to give stop, forward and reverse. Most motors need double pole change-over contacts, and this can be achieved with two GP5 contactors. In both cases, the cam position and shape can be varied to give the speeds in any set order. The versatility of the switcher is clear. Add to this its ease of construction, and reliability and it can be seen how useful the unit really is.

PILOT'S PAGES

BRISTOL M.A.C's invitational R/C Rally at R.A.F. Hullavington, Wilts, on January 10th promised to be an interesting diversion in the grip of winter, but unfortunately old man weather had other ideas throwing in blustery winds and rain.

The resulting modicum of competitor support turned the meeting into a "fun contest" with some off-beat and very entertaining competition. The organisers had erected two 25 ft. high poles between which pilots were asked to fly their models as many times as possible in a five minute period. To add to the fun, a 3 ft. balsa strip was placed vertically in the ground mid-way between the two uprights. A pilot managing to fly his model into contact with the balsa strip thereby gathering bonus points.

To fly a fast multi model low between the uprights in the blustery, slightly crosswind conditions required skill and considerable amount of nerve. Obviously though, this particular brand of runway roulette was very likely to end up with an argument between a model and one of the uprights as demonstrated when Geoff Franklin's Taurus II just clipped the top of one. However, it was left to Peter Greet (Leicester L.A.R.C.S.) to go the whole hog, the right wing of his Orion catching an upright squarely, twirling the whole model right round the

Heading: Runway roulette at Bristol M.A.C.'s R/C Rally. Geoff Franklin's Orbit Proportional equipped Taurus II dips low between the uprights to clip that 3 ft. balsa strip. Like the others, he missed. Above: Leicester L.A.R.C.S.'s Bob Horrell and modified A.P.S. Skyliner uses Merco 49 R/C and Franklin 12 radio gear. Left: Another L.A.R.C. Skyliner, this one by "Mac" Colyer, who reshaped fin and added open cockpit. K & B 45 powered. Skyliner 61 in. wing span is easy to build and gentle flight characteristics make it well worth considering as a 'first' low winger.

Out of the rut: Top left, J. Bridge, South Shore, Blackpool, built this K.K. Junior 60 and fitted floats. Power is E.D. Racer. Second and third down, Ron Ward and Dennis Allen ready their "Cyrano" for flight trials. Orbit Radio and Bonner servos tucked well forward.

pole before it reached the ground. With that, the game was terminated, Geoff Franklin (Taurus II) leading with 14 passes, J. Reynolds (Robbe Thor) 2nd with 12 passes and 3rd Ed. Johnson (Taurus), 11 passes.

A Pylon Race then ensued, but with a difference. Pilots' flew a timed lap, the time then multiplied by five, producing a handicap time against which a five lap course was flown. Geoff Franklin won this too, five seconds down on his handicap flying his Orbit Proportional equipped Taurus II. Second was Ed. Johnson with now much flown Taurus equipped with Min-X 12 reed gear.

Throttle Set-up Procedure for Super Tigre .56

Having heard comments on the difficulty experienced by some modellers correctly adjusting the Super Tigre .56 idle setting we obtained the following instructions recommended by an importer:

1. Close the idle needle (lower) fully and open 1½ turns.
2. Close main jet fully and open 2 turns.
3. Allow carb. barrel to close fully and cut off main jet to permit idle jet to flow correctly.
4. Start motor and lean out to peak r.p.m.
5. Throttle back to see if idle is smooth.
6. If idle is "lumpy" (misfires and runs unevenly) close down lower needle. In doing so, open up main jet to compensate. The two jets are interacting to a slight extent, the closing down of the idle jet having some effect on full power when the throttle is opened.
7. If motor continually fails to idle consistently, it may be necessary to open air bleed slightly.
8. Some well known multi fliers use 5-10 per cent petrol, but this additive is not recommended when the motor is fitted with a silencer as overheating may take place.

Engine at the Rear

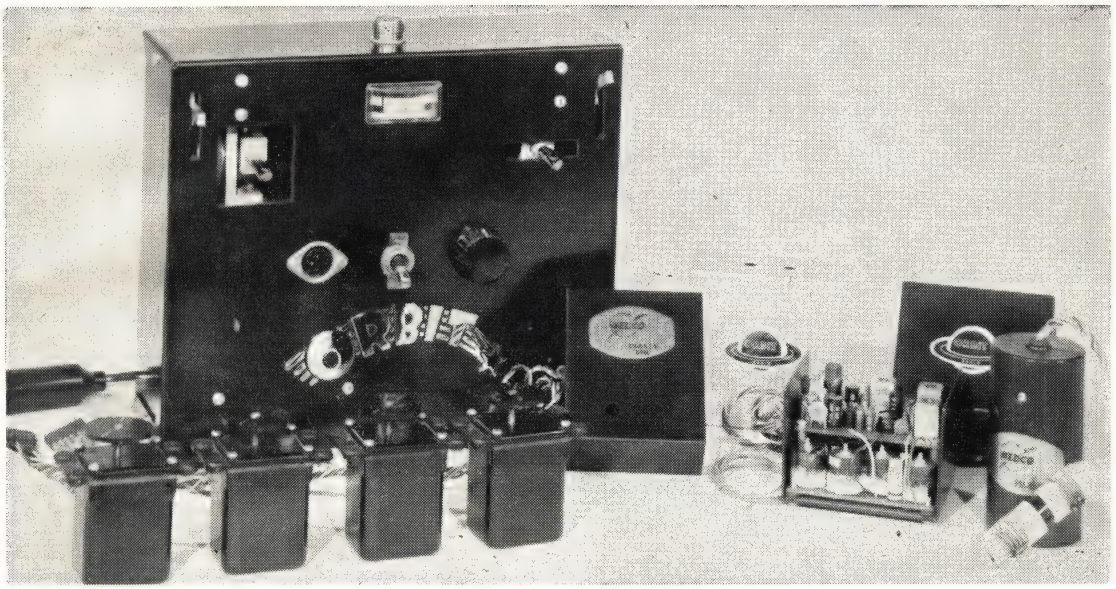
Brain-child of Dennis Allen and Ron Ward, the rear engined *Cyrano* at left is quite a 'hot one' by all accounts. This Merco 49 powered model is an attempt to increase airspeed without resolving to extra motor capacity, the designers' choosing the rear engined layout after watching F. W. Biesterfeld's Delta demonstrations at the 1963 World R/C Champs.

The greatest problem concerned fuel supply. A fuel tank just ahead of the motor would result in excessive C.G. shift during flight as fuel burned off, so a 6 oz. main tank was positioned at the C.G. with a 2 oz. header tank just ahead of the engine, crankcase pressure fed, with a needle valve in the line between the main and header tanks.

The heavy motor and centrally placed tank necessitated disposition of R/C gear in the long slender nose and the installation is shown opposite.

Ready to fly, *Cyrano* weighs 8½ lb. Dennis Allen reports an exhilarating performance and rather heavy landing, one hard touch down breaking off the nose. For the moment the project has been rested while the noseleg is moved back. Meanwhile Dennis piles on air-time with proportional equipment.

Quick de-coke ?



R.C.M. & E. Test Report Special

EDITORIAL REVIEW, TEST ANALYSIS AND PILOT'S IMPRESSION ON THE ORBIT QUADRUPLE PROPORTIONAL SYSTEM

WHEN we found that we could borrow an Orbit Proportional system for a few days for the purpose of conducting a test, we jumped at the opportunity. This is our first quadruple 'true' proportional test and a little extra work had to be carried out on the servo analyser, a special test recording device was also produced to enable proportional tests to be carried out. With the test facilities so extended we would welcome the loan of other proportional outfits for future reports.

Complete evaluation for proportional outfits cannot be had from measurements made on test gear alone. Indeed it is necessary to spend some reasonable time at the controls of a typical model before the complete story can be told. However, by providing the test figures obtained from bench operation under simulated flight loadings a comparison may be made between different outfits.

Such a comparison may be taken as a basis of evaluation of the complete outfit's consistency, reliability, accuracy of response, and ability to operate under conditions likely to be encountered in the average model.

This test cannot therefore represent the psychological effect produced by the weakest link in the complete proportional system . . . the pilot's reaction time.

Description

The Orbit system operates as follows. Two variable tones are used to control elevator and aileron. The aileron tone is varied about 1750 c.p.s. mean frequency and the elevator tone around 3500 c.p.s. mean frequency. The actual audio variation is quite small as will be appreciated by the spacing of these mean frequencies.

The tones are transmitted alternately and neither the amount of time spent transmitting each tone nor the *rate of repetition* can affect these control responses. It is possible to mark/space the two tones, variation in the symmetry of which provides the necessary information for the rudder control which is unaffected by the *frequency* of either elevator or aileron tone or the *rate of repetition.* The extreme rudder positions are obtained by varying the symmetry to 80/20, 20/80 per cent.

The throttle is controlled by varying the rate of repetition and is unaffected by the *symmetry* or *either tone frequency.* Raising the rate of repetition gives high throttle, lowering it for low. In the event of the transmitter ceasing to operate or a strong carrier on the same spot frequency blocking the receiver, the throttle servo receives no pulse so naturally runs to a slow position, no audio tones are received so the aileron and elevator servos return to neutral, the absence of mark/space information causes the rudder to centralise. All controls may be operated simultaneously without interaction.

The receiver is a superhet using 3 I.F. stages in a 7 transistor circuit, each elevator and aileron discriminator has two tuned filters with simple PNP/NPN output fed to the appropriate feedback servos, the rudder operates through a bridge network fed from the inputs to the two audio discriminators and a fourth circuit computes the rate of repetition from the rudder output.

The servos are true feedback closed loop systems using a 5 transistor amplifier operating from a centre tapped 4.8 volt supply which is common to the receiver. The transmitter is all transistorised and looks remarkably simple, however it is the choice of components and the tolerance thereof which make the design possible. The RF section is housed in a screened compartment at the top of the transmitter case and is fed via a pair of RFC 'lead throughs' from the coding circuit which occupies the lower left hand part of the case. There is plenty of room in the Tx case, a set of DEACs provide a 12v. supply.

This then is the basic system, we will now describe transmitter, receiver and servo, each with the appropriate test figures.

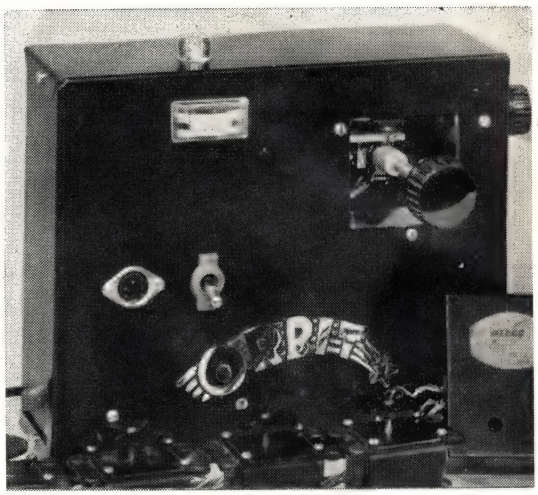
TRANSMITTER

Two versions are obtainable; single and twin stick. The single stick controls elevator and aileron and carries a knob on the top for rudder, throttle control is separately mounted and projects through the right hand side of the case above which are aileron trim and behind that elevator trim. The outfit under test was a two stick device; two short sticks are provided, the one on the left controls rudder and elevator movement, the one on the right the ailerons. The throttle lever projects through the front top right hand corner of the case and the elevator trim control in the opposite top corner. A knob below the aileron stick controls aileron trim. There is no rudder trim.

The elevator control pot is connected directly to the left hand stick and is mounted on a strong aluminium bracket to the rudder control pot, on which the whole assembly pivots. The aileron stick is simply clamped to the aileron pot shaft, itself mounted on part of the case. Both sticks have strong, positive and accurate centring, this centring is provided by scissor springs and the 'feel' of the sticks is extremely smooth; progressively more resistance is felt towards the extreme end of the deflection and a definite neutral 'notch' can be felt resisting unintentional rudder deflection when moving the elevator.

Providing the sticks are 'squeezed', that is to say the thumb placed on top of the stick and movement executed in a similar manner to bouncing an orange pip off the table, movement is smooth. The effect the spring tension has can only be ascertained by the pilot's individual preferences, it is however reassuring that when released the stick snaps smartly back to neutral, a fact that makes this system a relatively small step from reeds, in that experienced reed flyers can start by pulsing the sticks, if instinct takes over before they have developed the correct technique and, left alone the model once trimmed can be relied upon to assume a relatively stable neutral path, providing it is aerodynamically autostable and not in a 'knife edge' aerobatic trim.

The controls are easily accessible with the transmitter held in a similar manner to a reed outfit, it is however a bit of a stretch to make aileron control adjustments for trim. A larger knob for the purpose might be worthwhile. The transmitter had been in use for several months and was loaned for the test by Geoff Franklin who has put in many hours' flying with it. It was noticed that the aileron pot bearing had appreciable float, this may have been due to the pressure on the control stick, but might also indicate that an additional bearing would be worthwhile. The amount of wear did not affect the accuracy on the centring on the servo. (*We understand that the latest versions now have extra bearings.*) It is interesting to note that the rudder pot bearing did not show signs of wear, for although rudder is very rarely used, this pot bearing is subjected to greater loading due to the overhang of the gimbal assembly.



Heading photograph of the complete twin stick system including two chargers. Note the lid is removed from the receiver. Above: Single stick version of the transmitter.

The case of the transmitter is thin enough for comfortable control operation and balances well. The generous width of the case helps position the hands comfortably. There is no provision for preventing rain entering the case through the control stick apertures although tests seemed to indicate that this was not as important as might have previously been expected.

We restricted our tests to the operation of the complete system, as it is unlikely that modellers will attempt to mix the systems. Each individual transmitter, receiver and all four servos had been carefully matched to obtain satisfactory results and an exact analysis of the complex output of the transmitter must naturally be identical with the input conditions of the receiver. Similarly a servo's output from the receiver would naturally be compatible with the servo input requirements.

Physical Data

Size 8¼ in. wide, 7 in. high, 2¾ in. deep. Control sticks project $\frac{15}{16}$ in. from front of case.

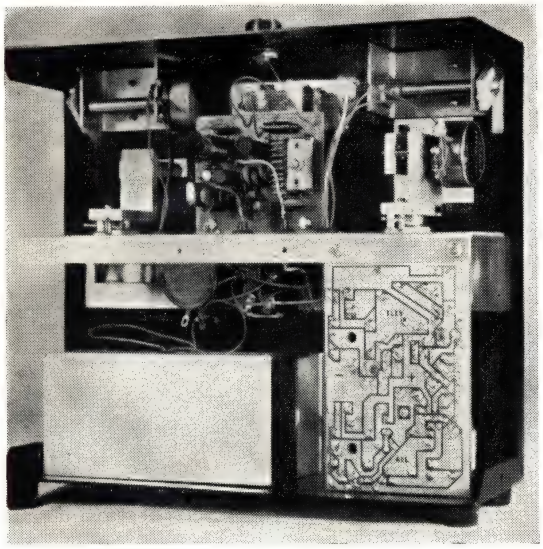
Aerial: Centre loaded telescopic.

Case

Black anodised aluminium 18 s.w.g. Two-piece folded construction.

Controls

Two main control sticks; elevator/rudder stick moves 1¾ in. total up and down, left and right in square aperture. Aileron similar length of movement. Elevator trim and throttle sticks have serrated tops and move 1½ in. vertically. Aileron trim control knob adjustable through 340 deg. Centrally placed on/off toggle switch. A meter of the edgewise type near the top of the case indicates the output level or Tx current. A charging socket is provided for the DEAC power supply.



The back of the Tx case finishes $\frac{1}{16}$ in. clear off the bottom, presumably to allow rain, which may enter the control stick holes, to run out.

Test Figures

Currents

12 volt input.
52 mA aerial extended case hand held.
60 mA aerial retracted case free standing.

Range

No extreme range check could be conducted in the time available but the fact that the outfit is in service in the competition field should indicate that the range is adequate for normal operation. A field strength indication, such as could be ascertained from the form of transmission employed was relatively high, it should be realised that no carrier indication is given, as there is always one or other of the audio frequencies present in the coded output.

Stability tests will be dealt with under complete system headings.

RECEIVER

Physical Data

Size $2\frac{3}{4}$ in. long, $2\frac{1}{4}$ in. wide, $1\frac{15}{16}$ in. deep.

Weight

$7\frac{1}{2}$ oz.

Harness

One supply cable $7\frac{1}{2}$ in. long terminating in Hurschman plug, four outlet cables 8 in. long terminating in Orbit 4-pin sockets.

Case

18 s.w.g. aluminium chassis, 22 s.w.g. aluminium cover anodised black. Receiver and discriminator circuits on $\frac{1}{16}$ in. glass epoxy printed circuit boards arranged in two decks. Each pot core in the filter section is pin mounted on its own plastic base and appears to be coated with an anti-humidity compound.

Each output cable comprises battery supply (plus, minus and centre tap); red for positive, blue for negative, white centre tap and either brown (aileron), yellow (elevator), orange (rudder) or green (motor) signal input lead. The plugs and sockets are polarised to prevent incorrect connections. We did not try transposing the servos, although the manufacturer now claims that they *are now* interchangeable.

Test

Currents

No separate current reading was taken for the receiver which operates from the servo battery, lowest reading obtained was 180 mA with all servos connected.

Sensitivity

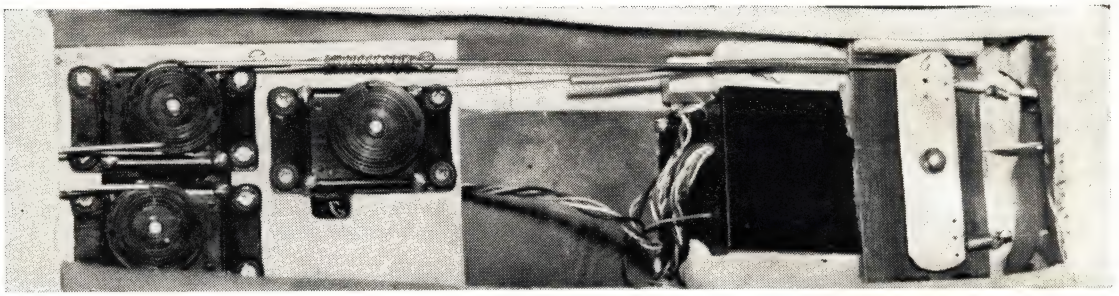
An approx sensitivity test was conducted by feeding an RF signal generator output via an indirect coupling loop to the aerial. The signal was modulated at 1750 c.p.s. and adjusted to produce a movement in the appropriate servo. The input was then reduced until a condition was reached just before the fail-safe came into operation. These conditions were translated to give an estimated sensitivity of between 2 and 3 μV.

Interference

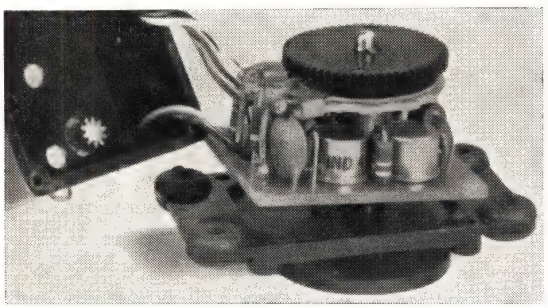
Whilst a strong blocking carrier on the same frequency gives fail-safe, various continuous tone signals produced a number of interesting conditions. In all cases the throttle servo ran to slow position, in some cases the rudder gave partial or full deflection or the aileron or elevator servos moved off neutral intermittently. For general purposes however, it may be assumed that the system is almost entirely fail-safe as the chances of the receiver picking up the type of interference previously referred to would seem to be very remote.

SERVOS

All the servos appear to be identical and comprise what appears to be a TO3 Micromax type of motor which has integral gearing and is mounted in the lower part of a moulded plastic case. Next comes a separating plate which forms a bearing for the output shaft. The output shaft is $\frac{1}{8}$ in. diameter alloy (might be dural) and carries a nylon gear which engages in the output pinion of the motor. The shaft passes through, and drives the wiper assembly of a



carbon potentiometer track unit, this appears to have been taken from a cased type of pot as it has a wide flange with integral lugs. This is mounted on two stiff wires above the printed circuit board which carries the amplifier components. The whole assembly is retained by the lid holding down the bolts and the output shaft is fitted with an output disc drilled at 90 deg. for pushrod linkages. Although the bush of this disc is drilled for a locking pin, the examples on test were not locked in this way. (*We are informed that latest examples have tubular locking pins although the examples on test were quite tight on their shafts.*



The servos have to be mounted on transverse or longitudinal bearers or passed through holes in a plywood plate. Four woodscrews are used through the rubber grommets provided in the lugs.

The cases remind us of the Hillcrest motor servo, perhaps the same source of case supply is used, they are quite resilient and should afford protection to the servos, although the output shaft is rather long and might bend in a heavy crash. It could however be shortened quite easily.

Physical Data

Size $1\frac{3}{8}$ in. long (plus $\frac{5}{16}$ in. lugs each end) $1\frac{1}{4}$ in. wide by $1\frac{15}{16}$ in. deep ($1\frac{5}{8}$ in. from underside of lugs to bottom of case) output disc projects a further $\frac{1}{2}$ in. from the top of the case.

Output disc is $1\frac{1}{16}$ in. diameter and is drilled $\frac{1}{2}$ in. radius to suit 16 s.w.g. pushrods. Concentric lines moulded on the face of the disc are intended to assist modellers in drilling fresh holes on similar, but different radii from those existing.

Case Material

Two piece moulding in black resilient nylon type plastic.

Cable

Cable comprises four leads 8 in. long terminating in polarised 4-pin plug to suit output cable from the receiver and is similarly colour coded.

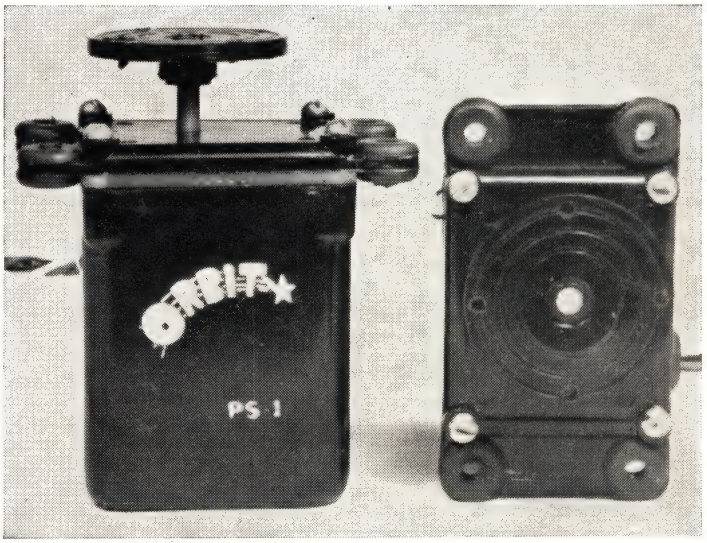
Test

Current

Combined current reading was taken with all servos connected to receiver on common battery (2.4v. + 2.4v.).

One servo moving under 12 oz. load	450 mA
One servo stalled	550 mA
All four servos moving simultaneously under load	650 mA

450 mA would therefore seem to be the average current drawn during aerobatic manoeuvres requiring continuous change of servo position. These figures



Opposite page: Inside shots of Tx (top) and Rx (bottom). Above (upper): Simple installation, note rudder/nosewheel linkage to nosewheel bellcrank over Rx. Servo amplifier (lower). Full-size servo shown right.

are difficult to assess as each servo quickly assumes its new position when commanded and readings are of a short duration. The current readings were taken in the 2.4v. input so that the current drawn from each half of the battery could be assessed.

Output

Readings taken with pushrod connected in $\frac{1}{2}$ in. radius hole in the output disc.

Maximum load for full cancellation of error: 14 oz.
Servo stalls at: 30 oz.

Although the power output from the servos may not appear to be as high as that obtainable with reed operated actuators, once the control surface has been deflected, it requires considerable force to reduce that deflection, in fact we did not succeed in displacing the servo from its deflected position as at 4 lb. we felt that further increase of the loading would damage the servo.

It is doubtful whether such loads would occur in flight, certainly it would appear that loads of this order would be unlikely to be met until the servo had deflected the surfaces. Proof of this is that fast aerobatic models have been flown successfully by many users of this equipment.

Output Throw

Approximately 45 deg. each side of neutral, this translated into a push-pull motion of the pushrod, gives $\frac{3}{8}$ in. each side of neutral. The trim gives $\frac{5}{32}$ in. Total movement is therefore $1\frac{1}{16}$ in. (up plus up trim, to down plus down trim).

Complete Equipment Test

Two further tests were conducted to ascertain the complete outfit's voltage and temperature stability.

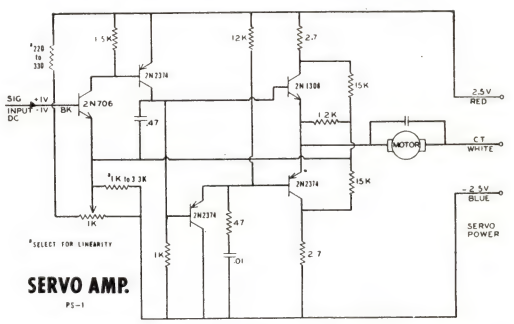
Voltage Stability

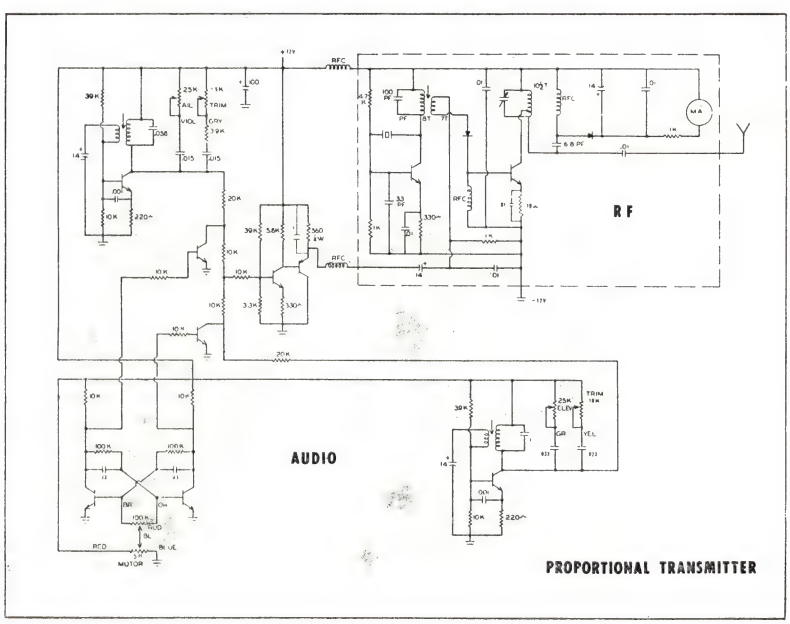
All four servos were fitted to a recording device so that drift could be measured simultaneously, the voltage of the transmitter was reduced progressively to 5.6v. (less than half) with the following results. Throttle moved 25 deg. towards slow end, rudder moved 3 deg. left, elevator 35 deg. up. It was impossible to obtain down but neutral could be reached, aileron moved 10 deg. left and only 35 deg. right was possible. All servos returned to neutral when voltage was increased to 9.6.

Reducing the voltage of the receiver/servo supply to 1.5v. + 1.5v. resulted in slow servo response and reduced sensitivity, rudder control seemed inconsistent and throttle hunted. Servos returned to neutral condition on changing the voltage to 2v. + 2v. Normally the batteries would not be allowed to run down to this extent, our test used external supplies to provide the lower voltages.

Temperature and Humidity Stability

The transmitter and receiver was placed unprotected in the freezing compartment of the refrigerator and reduced to approximately zero F., on re-connecting the servos (Tx and Rx were covered in frost and started to drip water). Throttle moved 5 deg. towards slow end, rudder 1 deg. right, elevator $1\frac{1}{2}$ deg. up, aileron $2\frac{1}{2}$ deg. left. The equipment was then heated to 140 deg. F., there was no noticeable deviation of the original neutral position.





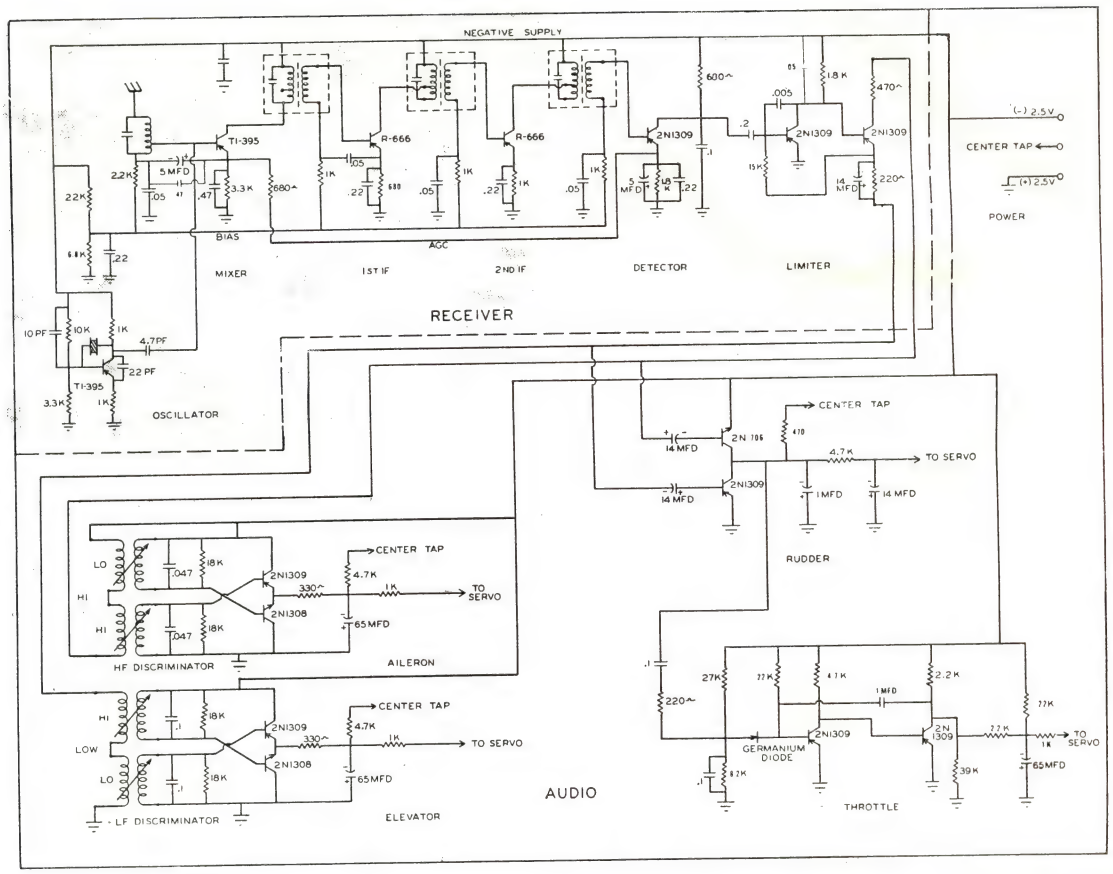
NOTE: Tx tested was 12v. type, latest are 10v. and servos have 6 transistors. Circuits are from leaflet.

In order to assess the effect of rain entering the control stick apertures, the solder tags on the pots in the Tx were wiped with a wet sponge, there was a barely persceptible drift on elevator.

Weak Signal

An extreme range was simulated by removing the Tx aerial and placing the Rx aerial in a screening can, taking the Tx further away until controls became intermittent, the amount of drift obtained by this method produced slow engine, 5 deg. right rudder, 20 deg. up elevator, 10 deg. left aileron.

The pilot would probably notice a lesser degree of



drift before he flew the model to the limit of its range.

For general guidance in assessing these drift recordings, it should be noted that as each servo normally travels 90 deg. total movement that the *percentage* of the drift is really quite small. For example; 1 deg of drift recorded represents 1/90th of the total control surface travel and apart from the extreme low voltage test on the Tx, the drift is easily accommodated in the trim control. This does not however apply to rudder.

Vibration and G

The complete airborne installation was too bulky and too heavy to accommodate on the analyser, but one servo was tested in this way.

Vibration

The rubber grommets absorbed approximately 55 per cent of the vibration present in the mounting plate. The remaining 45 per cent vibration did not affect the operation, other than to produce a corresponding vibration of 'control surface' trace. The unit was run up to 10G with no measurable change in performance.

Lag and Overshoot

The transmitter was fixed so that a pushrod could be connected to the aileron control stick, this pushrod moved second recording pen to produce a parallel trace on the recording tape. With the servo producing a similar trace under 'flight' conditions it was possible to measure the accuracy, lineality and lag in the complete control system. Readings obtained were translated to give the following figures. Neutral to full position 0.15 sec. command, 0.45 sec. operation. Releasing stick at full position stick returned in 0.1 sec. (command), servo neutralised in 0.355 sec.

It will therefore be seen that the maximum lag is 0.255 sec. between the control stick moved at its fastest possible rate and the servo position. This response time is considerably better than the average 'Bang-Bang' reed outfit.

Lineality

Both traces were made with the same amount of deflection so that incremental stages of deflection could be compared to give an indication of the lineality of control. We found it impossible to measure any degree of non-lineality indicating excellent linear performance.

Overshoot

The amount of damping employed in the servos was adequate to prevent overshoot under load, although approximately 2 per cent overshoot occurred on returning from loaded full deflection to neutral when the stick was released. This again is less than that generally found with reed controlled actuators. The servo resumed neutral in the same oscillation.

Throughout the servo recording test the servo was loaded zero at centre to 12 oz. at maximum deflection to simulate a normal free linkage installation under operating conditions.

Summary

Performance

Accurate response, consistent operation and adequate servo power. The stability of the outfit is considered more than adequate for competition flying under varying weather conditions and the voltage stability indicates that the manufacturers estimated endurance of an aggregated flight time of over 3 hours is a conservative one.

Installation

The receiver is sufficiently compact for most models likely to be flown with quadruple proportional equipment and the servos are relatively easily mounted. Geoff Franklin sent along the elevator, rudder and throttle mounting plate which he has produced for his next model. The plate is $\frac{3}{16}$ in. hard balsa sheet with holes cut to clear the servos and scraps of bardwood bearer glued in place. We were informed that this type of mount would break up in a heavy crash, reducing the chances of damage to the servo lugs, which might occur if a more robust form of mounting were used.

The receiver battery pack could have been more solidly constructed, the example tested had been previously crashed and the lid and bottom of the case (quite a thin plastic) had broken, the whole case was bound with plastic tape. We would think that an additional wrapping of sponge rubber *taped* in place would seem a worthwhile recommendation if added to the instruction sheet. The system is fail-safe but the model should be trimmed for stable flight with the servos in the fail-safe neutral position, the trim neutral will naturally be slightly different than that selected by the transmitter stick control. However with the aforementioned trim positioned centrally there is a change in neutral between fail-safe and transmitted neutral of 3 deg. right on the rudder (we would have liked to have seen a rudder trim control), 5 deg. up elevator, 2 deg. left aileron, throttle moves to slow under fail-safe condition. All the servos hunted slightly in the fail-safe condition; aileron, elevator and rudder twitched between about 4 deg.

The fact that the rudder moves a little off neutral in fail-safe would probably be an advantage in a stable model.

Weight

The airborne payload at 26½ oz. is made up as follows. Rx at 7½ oz., each servo 2¼ oz., battery 9 oz., plus plugs, sockets, harness and switch. This is quite a load to distribute in a model but scarcely more than a 10 channel reed outfit with five of the heavier type of servos and separate receiver batteries.

Servicing

This type of proportional outfit cannot be serviced by the average modeller, but the British service centre is available for such work.

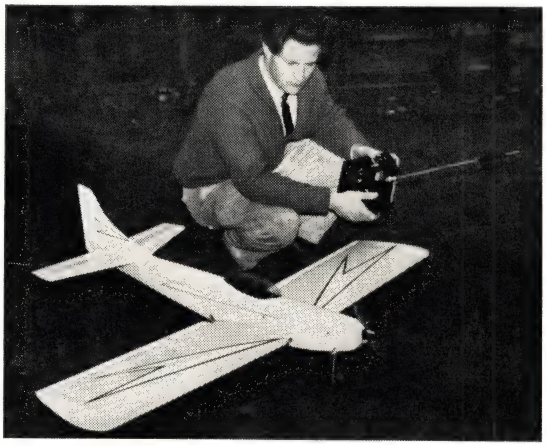
The outfits are available, although we hear at the moment that there is a waiting list.

Manufacturer

Orbit Electronics, 11612 Anabel Avenue, Garden Grove, California.

British Service

Orbit Service Centre, 98 Grassmere Street, Leicester.



PILOT'S IMPRESSION

By Reg Grimmett, Chesham R/C M.A.C.

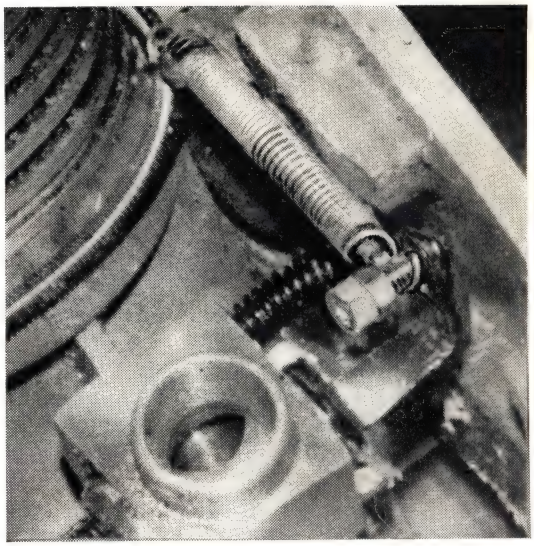
To the best of my knowledge, mine was the eighth Orbit proportional imported into G.B. and is a perfectly standard two stick production unit. Naturally enough we all (my friends included) regarded the new system with a certain amount of awe when first delivered and there ensued a considerable amount of 'hangar flying' debating the best way to instal the gear, hold the transmitter, tweak the control sticks, in fact a general bull-session. When all the talk was over though, we had to sit down and work the problem out.

Being a completely wired system, installation is a simple enough job once one has become accustomed to the possibilities. Previously I have flown an Orbit/Bonner multi reed rig which was a considerably tighter fit inside the radio compartment than the proportional set which permitted much more freedom.

One of the biggest disadvantages with my Orbit is the failsafe position of the throttle servo which travels quite a long way past normal low throttle position when in the failsafe state. I overcame this with the linkage illustrated. Here a piece of brass tube is sweated on to the end of the throttle pushrod. Over the tube a Radiospares extension spring is placed, secured at the sweated end of the tube, with the free end attached to the throttle arm. Then, when the throttle servo overtravels on failsafe, the spring takes up the strain. Without the spring it would be necessary to use a rather springy linkage which would not provide a very positive response to servo position. Incidentally, I understand that the overtravel has been practically eliminated on later examples by the insertion of a diode somewhere in the circuit.

Flying proportional proved no great problem. I already had some three years' multi experience behind me, so I was at least fairly confident although when the time came for the first flight I was naturally apprehensive. My first proportional model was a low wing Allegro with which I had already accumulated some 150 flights when using reed equipment (genuine count — no line shoot). Flying with the new system proved far easier than I had expected. Mine is a two stick transmitter with primary controls (elevator and aileron) as per a reed transmitter. This I like and strongly recommend. Some bright spark said, "One stick is like flying a bag of worms".

Left: Reg Grimmett and Orbit Proportional equipped Skyliner slightly modified. Model with R/C equipment and Merco .49 R/C motor weighs 6½ lb. Right: Spring loaded throttle linkage, which takes up the over-ride on the throttle servo when latter moves to fail-safe position.



With this arrangement, control manipulation is not unlike bang-bang control in that although I only apply a very little control movement for smooth turns, the whole servo movement is used for aerobatics. There does not appear much necessity for "in between" positions. To accomplish a shallow turn I lay my thumb on the case alongside the control lever and apply just a slight amount of pressure to the stick, which is twice the length of a reed type Tx lever and just about the right size. The model will then slowly drop a wing and I apply just a slight back pressure on the elevator/rudder lever to hold the model's nose up in the turn. This I feel is the basis of proportional flying and it is also worth noting here that the harder you try, the more difficult it seems to become. During turns I have found it necessary to apply slight opposite aileron to prevent the model tightening up in the turn. The cure for this is extra dihedral and as far as I can tell, this is about the only necessary difference between reed and proportional equipped aerobatic models.

Naturally the big question surrounding the Orbit and other proportional equipment concerns price. Is it really worth the cost of a Mini-van (minus a wheel or two perhaps)? The answer I feel depends on the amount of enjoyment you can obtain from it. If you fly regularly then you will get your fair share of R/C fun from it. If you fly only when the sun is shining and there's no wind, then maybe it's best to settle for a less expensive control system.

Why the high price tag? In terms of components there is not really a great deal more in the Orbit proportional system, than there is in a 10 channel reed system. This applies particularly to the transmitter and in fact the entire system including servos with about the same number of transistors as a 10 channel superhet reed rig. The cost therefore may be attributed to protracted development programmes.

Summarising, I am glad I took the plunge into proportional even at this expense. My equipment has operated faultlessly over the three months I have now been flying it and I would not want to part with it now.

R/C 'E' TYPE JAG

(*Continued from page* 159)

ceiver itself is wrapped in sponge plastic and wedged into the rear of the bodywork. A piano wire whip aerial replaces the scale aerial and is wired to the receiver.

All the parts are readily accessible through either of the doors, and the bonnet lifts completely off limited only by the head lamp and trafficator leads. Two small self-tap screws fit aluminium brackets on the scuttle and serve to hold the bonnet down. The receiver consumes little power so the system can be left on for some time. Although the main drive batteries have quite a load to handle, for the car originally quite light, now has about as much weight as an equivalent model boat and when travelling fast in a small room needs prompt throttle commands. The transmitter is non-simultaneous so that one must remember not to hold full lock on the steering while selecting stop or speed change. This makes three point turns tricky until you are used to the system. A power centring steering servo can be pulsed to give wide turns and quite accurate steering.

The E-type took about 50 hours actual construction time but many more of silent meditation before the design of the installation was complete. Separate batteries were used to save a few extra hours of brain work in the wiring of the receiver relay and actuators, but the general principle involved in controlling the Jag may be employed for various other 4 channel outfits. The main points to watch are:

1 Keep the Rx and its aerial away from the drive motor if it is sensitive to interference.
2 Use fast acting servos and learn to pulse the control briefly for wide turns.
3 Make the steering strong and free from loose joints.
4 Try to arrange at least two fixed speeds, stop and reverse if you cannot work out a smoother form of control.
5 By using a large scale subject, other special effects can be tried. (James Bond types please note.)
6 Be prepared for dented or shattered bodywork if your first attempts are made with high gear ratios or hot power units. . . . Happy motoring.

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Just in case newcomers to Radio Control are not aware of it — you need a licence for operating remote control equipment. No tests, just fill in a form and pay £1 for five years' cover. Application form and full particulars from Radio Branch, Radio & Accommodation Dept., G.P.O. Headquarters, London, E.C.1

Commercial Developments

CONSUMER STAFF MEMBER TONY DOWDESWELL SAMPLES NEW PRODUCTS AT HOME & ABROAD

VYING for the number one spot in R/C conversation with such topics-of-the-moment as the advent of proportional conrtol, and the now somewhat hackneyed Walkie-Talkie problem is that guardian of the flying field, the engine silencer.

The engine silencer has received a much greater commercial response than your scribe had thought possible. Nevertheless in instances like this it is a pleasure to be wrong. The range of mufflers available commercially is already extensive as our February issue survey recorded, and the deficiencies in the range are being rapidly minimised.

Being an avid user of Cox engines for pylon racers, Pete Russell of Model Centre, Worksop and Lincoln, has spent some months developing high performance silencers.

The final unit consists of a machined eccentric annular expansion/collector manifold with a ¼ in. outlet pipe. The latter can be replaced by a 'straight through' type chamber which costs an extra 10/6d. but has no further effect on performance while further substantially reducing the noise level.

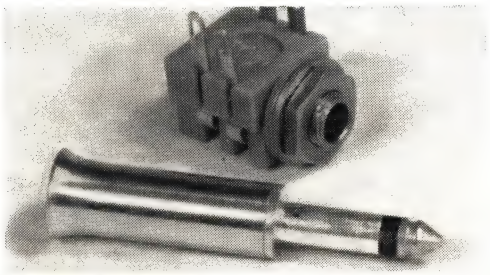
Extensively air tested, both with and without the extra chamber, the average results of test reading indicated that a silenced Cox .15 motor turned an 8 x 4 in. prop at 13,800 r.p.m. whereas unmuffled the figure had been 14,700 r.p.m. With muffler in place, needle valve setting became less critical, but no other variations in performance were observed. Cost of basic unit for Cox .049, .09 and .15 motors is £1.5.6d. and the second expansion chamber is an extra 10/6d.

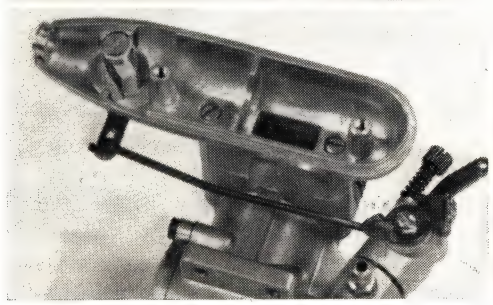
Oliver motors are now supplied ready to accept silencer and manifold. If you want your existing "Olly" machined to take a silencer, this can be done for 7/6d. and total cost including fitting of Oliver Silencer will be £1.11.2d. including post. New engines ordered complete with silencer will cost £1.0.0d. extra for this benefit.

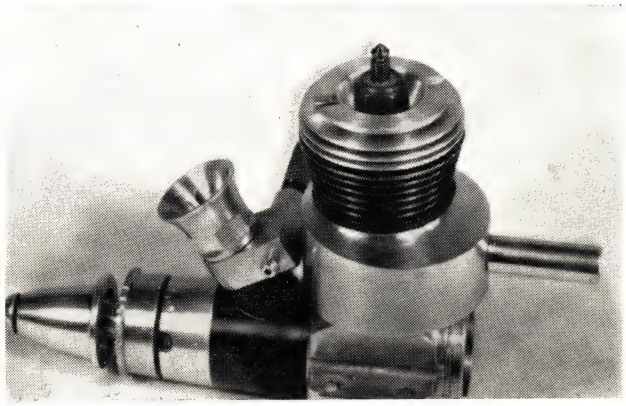
The **D.A.C. Spinaflo** range has recently expanded again to fulfil the requirements of more than 60 types of engine, so that if you are still looking for a muffler for your particular motor there is a good chance that there will be one to suit in this range.

By pure coincidence, a visit to our local model shop "Models", St. Albans Road, Watford, Herts, we were able to examine a new version of the **O.S. Jetstream** silencer, which was hitherto unknown to us. The fitting of a silencer usually necessitates the removal of the throttle exhaust shutter, but the latest Jetstream substitutes this with a machined alloy butterfly valve situated in the rear part of the expansion chamber and linked via external take-off arm to the carburettor barrel lever in the familiar manner. Two sizes are obtainable one for .15 and .19 cu. in. O.S. motors, price £1.10.9d., and the other for the .29, .35, .49, and .50, price £1.16.2d.

From Henry J. Nicholls Ltd. comes the **"308" Silencer** range made to suit any engine on request. **Cox, McCoy, Veco** and **Frog** motors are cited as particular examples. These compact mufflers are made from shim brass, with an expansion chamber of oblong section silver-soldered along the seams. Even the tiny **Cox Pee Wee** motor is catered for as we mentioned briefly last month. Prices from £1.5.0d.







Left: Miniature Jack plug from Radiospares. Bottom left: New O.S. Jetstream Silencer showing butterfly restrictor in rear of expansion chamber connected to throttle lever by wire coupler. Below: Peter Russell's silencer for Cox .15, shown without second expansion chamber. Other sizes fit Cox .049 and .09.

Right: R.C.S. Inter 6 R/C system comprises transmitter receiver and Climax Servo Pack. Airborne installation system is supplied completely wired with switch and battery harness. DEAC power pack is an extra

R.C.S. Package Deal

Package deals in R/C equipment, usually aimed at the R/C beginner, whether single channel or multi, are not really new, but nevertheless a commercial approach we would like to see more frequently.

The latest introduction by R.C.S. is their **Inter 6** system. This complete 6 channel system comprises an all transistor 12 volt working transmitter, super-regen or superhet receiver depending on customer's choice and completely wired servo pack.

The 6 channel transmitter and receiver are standard R.C.S. items and the receiver, either superhet or super-regen incorporates a six reed unit whereas all R.C.S. multi receivers have hitherto used a standard 10 or 12 reed unit.

C & L Developments prepared the servo pack specially to suit the R.C.S. system. Three C & L Developments' transistorised Servomites are mounted on and wired to an etched circuit installation tray size 5½ x 2¼ in. much after the style of C & L's already established servo packs, with special vibration damping rubber mounting grommets. The receiver feeds the servo pack via a B9A 9 pin connector, the socket of which is soldered into the servo tray and the 7.2v. DEAC power pack harness complete with slide switch connects to the baseboard in like manner via a 4 pin plug.

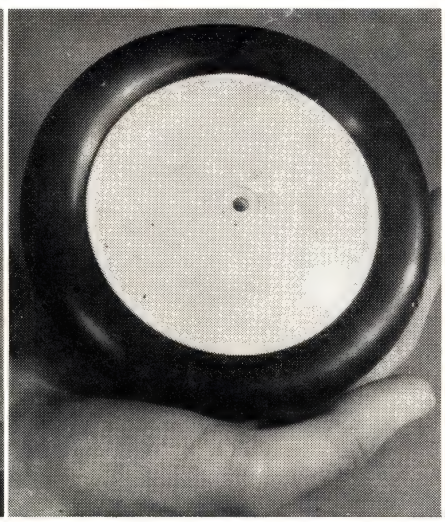
The Inter 6 is likely to have a wide appeal. It takes the headache out of the installation problem and is an introduction to multi channel R/C at a reasonable all-in price. The airborne installation weight of the super-regen version complete with 7.2v. 225 DKZ DEAC pack is 12½ oz. and with the superhet receiver just ½ oz. more. The former costs £56.0.0d. and the latter £69.10.0d. although in each case the DEAC power pack is a £3.6.0d. extra.

Scale Wheels

Scale fans, particularly those with a soft spot for W.W.1 aircraft, will drool over the W.W.1 and vintage type **scale wheels** from William Bros., now added to Henry J. Nicholls' Ltd. stocks. These have cream hubs moulded in high impact plastic and tough, flexible black plastic (possibly Neoprene) tyres. The largest are 5 in. in diameter, weigh 7 oz. per pair and make you want to build a W.W.1 scale beauty just for the sake of using a pair, even if they do cost £2.19.6d. Other sizes are 3¾ in. dia., price £1.19.6d.; 2½ in. dia., 19/6d.; and 1⅞ in. dia. at 12/6d.

Other useful accessories from H. J. Nicholls' shop include sheets of **glass epoxy copper laminate** size 9 in. x 3 in., price 6/-. At this size the sheet is just right for an etched circuit servo installation tray to which purpose our sample was quickly applied! Also from this source, the range of **"308" Clunk Tanks** in the usual polythene bottle style, but with a single vent in the cap for the fuel line and twin vents in the bottle. Sizes available are 2 oz. 5/6d.; 4 oz. 6/-; and 8 oz. 7/6d.

Below left: Radiospares Contact Cleaner in aerosol spray can. Centre: Monster sized scale wheels by Williams Bros. This one is 5 in. dia. Right: "308" Clunk Tanks.



Min-X Price Reduction

A price reduction at any time is a welcome surprise, but for an import during a period when a 15 per cent surcharge is being levied on all imported goods, this is something which R/C fans might consider an excuse to dance in the streets about. (Well, not really, but at least it's encouraging). Ed. Johnson now offers the **Min-X Powermite 6 and Superhet 6** combo for £58.10.0d.

One of the attractions of this system is that the purchaser is not limiting himself to six channels for he can, if he eventually desires, return his equipment to the Servicenter for conversion up to 12 channels, paying only for materials used. Convertibility is a planned feature of the Min-X 6 combo. The 6 channel all transistor transmitter, which works off a 9v. dry battery is already bi-simultaneous. On the etched circuit component board provision is already made for the additional control levers which merely require soldering into the circuit after the case front face has been suitably drilled. Likewise the positions for the extra tone pots are ready marked on the circuit board.

The receiver, which weights 4 oz. and measures $2\frac{15}{16}$ x $2\frac{1}{8}$ x 1 in. is a six transistor, 6 volt working superhet with four I.F. stages. A Min-X 6 reed block is employed, which can be replaced by a 10 or 12 reed unit. However, if conversion is contemplated it is suggested that the customer purchase the Rx with the larger reed bank already fitted.

Contact Cleaner

Radiospares Contact Cleaner is an aerosol spray. Although not the kind of thing to use on a reed bank, it does clean tarnished switch and relay contacts, prevents further tarnishing and inhibits sparking. It is of best value for heavy duty contacts and is effective on components like P/C switcher plates, metal motor brushes, and pot tracks. Price 14/9d.

Also from Radiospares — a miniature jack plug and socket price 6/-. This company does not supply direct, but most radio component stockists and some of the larger model shops carry some of the Radiospares range. (Retail prices vary.)

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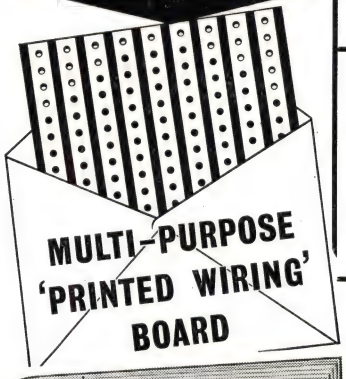

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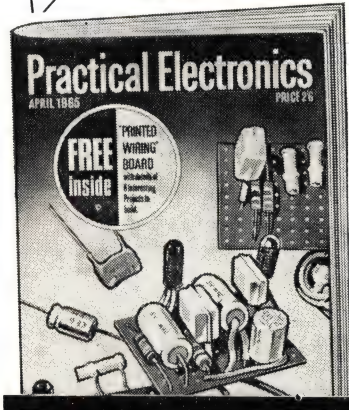

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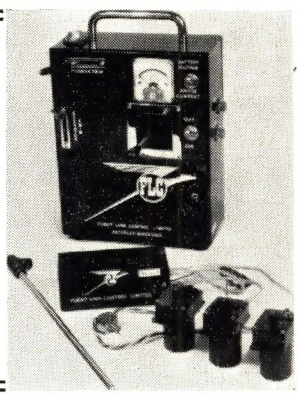

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